EXPLORING THE USE OF ARGUMENT IN IMPACT ASSESSMENT:

A CASE FOR IMPACT SIGNIFICANCE ARGUMENTS

By

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We accept this thesis as conforming
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Abstract

Determining the relative "significance" of the potential impacts of proposed development projects is a challenging part of the impact assessment process. This study uses argument analysis methods to evaluate seven key features of 33 arguments about impact significance published by the British Columbia Environmental Assessment Office. The findings indicate that, although sufficient data existed, the arguments supporting conclusions about significance were weak and were not explicitly substantiated in several ways. Since the weaknesses were in multiple aspects of the arguments, tools from the field of argumentation could be used to improve them. Recommendations offer methods to better justify significance determinations as strong arguments, such as clearly defining key terms, presenting explicit and comprehensive reasons for conclusions, and presenting specific types of reasons. Because argument is a familiar form of communication, it can make significance determinations understandable to a wide audience, thereby contributing to the transparency of the impact assessment process.

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Chapter 1: Introduction

Impact assessment is used in over 100 countries (Noble, 2010) to facilitate sustainable development of major projects, such as mines and energy projects, by assessing potential project impacts and identifying ways to avoid or reduce adverse impacts. In impact assessment practice, determining the relative "significance" of project impacts is a vital process that occurs at several stages. Implicit and explicit determinations of impact significance ("significance determinations") form the basis of major decisions throughout the process, including screening, scoping, and project approval decisions (Lawrence, 2000; Noble, 2010; Sadler, 1996; Sippe, 1999). At the culmination of the process, the assessment narrows to overall determinations of the significance of predicted impacts (Kruger, 2009; Sadler, 1996). Impact significance determinations at this culminating stage form the basis for deciding whether proposed projects are granted or denied permission to proceed (Lawrence, 2000; Noble, 2010; Sippe, 1999; Sadler, 1996) and are therefore particularly important.

Despite the critical importance of impact significance determinations, over 40 years of practice, and almost as many years of research and recommendations to address shortcomings, the practice of impact significance determination is a source of concern and controversy in the impact assessment literature. For example, Wood (2008) notes "it remains one of the most complex, contentious, and least-understood aspects of [impact assessment] systems across the globe" (p. 23). Perhaps this is because, according to David Lawrence (2007b), a preeminent scholar on the topic, "the question of how best to go about determining the significance of impacts has, to date, only been addressed in a partial and preliminary way" (p. 730).

One of the major challenges noted in the literature is a propensity for impact assessment documents to not adequately explain the reasons and rationale supporting conclusions about

impact significance (Haddock, 2010; Lawrence; 2007a; Ross, Morrison-Saunders, & Marshall, 2006; Rossouw, 2003; Wood, 2008;). It is likely that this challenge is related to other shortcomings noted in the literature, including a tendency to not define the concept of impact significance in legislation or in assessments (Haddock, 2010; Kruger, 2009; Lawrence, 2000) and a tendency to not adequately explain the measures by which significance is judged (Ross et al., 2006). Wood (2008) suggests these and other challenges tend to result in poorly substantiated significance analyses and conclusions.

Challenges similar to these have been noted by impact assessment practitioners at the Environmental Assessment Office (EAO), the government agency responsible for administering provincial impact assessment in British Columbia. This study was initiated due to the interest that staff at the EAO had in exploring the topic of impact significance. In particular, during the early stages of this study, senior EAO staff expressed interest in having this study explore how impact significance determinations could be carried out in more consistent ways and how conclusions could be better substantiated. This led to the initial research question, which was: How can impact significance determinations be better substantiated? This question guided a review of the impact assessment literature during the early stages of the study and led to a focus that guided the remainder of the study.

The impact assessment literature offers numerous recommendations for improving impact significance determination practice. A major theme is that impact significance determinations should be clearly substantiated so that the basis for significance conclusions is apparent and traceable (Glynn, 2004; Haug, Burwell, Stein, & Bandurski, 1984; Kruger, 2009; Lawrence, 1993, 2005; Noble, 2010; Ross et al., 2006; Sadler, 1996; Sippe, 1999; Wood, 2008). Lawrence (2007a) suggests that “reasoned argumentation” approaches to impact significance

determinations effectively substantiate conclusions by explaining the reasons supporting conclusions while effectively incorporating both technical and value based types of data. Argument is also a form of communication that is widely understood by varied audiences (Lawrence, 2007a) and can therefore contribute to the accessibility and transparency of impact significance determinations, and impact assessment in general. Lawrence (2007b) observes that argument is a fundamental element of impact assessment, yet little attention has been directed at how argument is and can be applied in impact significance determinations. Indeed, during an extensive review of the impact assessment literature, I did not encounter any specific suggestions about how the tools from the field of argumentation could be applied to impact significance determination practice. This observation led to an insight that this study could be set within this apparent gap in the literature.

The field of argumentation offers a wealth of observations, tools and recommendations on how to build strong arguments that could be applied to procedures for impact significance determinations. The argumentation literature suggests that strong arguments are arguments that are well-organized, clearly communicated, and present complete and appropriate reasons to support conclusions (Govier, 2005; Scriven, 1976). Ultimately, a strong argument is one that is sufficiently convincing to gain the agreement of an audience (Brown, 2011).

The objectives of this study are to explore whether and how the impact significance determinations at the culmination of the impact assessment process are, or could be, justified as strong arguments. The study is guided by the following research questions:

- To what extent are impact significance determinations justified as strong arguments in provincial impact assessment in British Columbia?

- What methods can be used to better justify and communicate impact significance determinations as strong arguments?

To answer these questions the study researches the literature on impact significance and argumentation and uses argument analysis methods to evaluate arguments presented in a sample of impact significance determinations. A review of the impact assessment literature explores the concept of impact significance, identifies approaches used for judging significance, and identifies recommended practices for producing well-substantiated significance conclusions. A review of the argumentation literature investigates the major characteristics of arguments to identify specific methods for substantiating impact significance conclusions as strong arguments. Using argument analysis methods gleaned from the argumentation literature, the study uses a systematic approach to analyze and evaluate the strength of the arguments presented in a sample of 33 impact significance determinations from 11 Assessment Reports written by the EAO.

The research recorded here shows that there are challenges with several aspects of the arguments in the sampled impact significance determinations. There is as a tendency to not present or fully explain the reasons supporting conclusions and a lack of clarity around the intended meanings of key terms. Many of the noted challenges in the EAO documents are similar, in general, as those that the impact assessment literature indicates have been noted in other jurisdictions. However, this study permitted a more detailed analysis and more specific diagnoses. In response to the findings, the study culminates with a series of recommendations on how impact significance conclusions can be better substantiated through what the literature defines as strong arguments.

Chapter 2: Literature Review

This literature review addresses impact assessment and the practice of determining the significance of impacts. A brief overview of impact assessment is provided to set the context for impact significance determinations. After that, a discussion of impact significance explores the characteristics of impact significance determinations, approaches used to determine significance, and an overview of challenges and recommended responses noted in the literature.

Impact Assessment

Regulated impact assessment practice was first established in 1970, under the United States National Environmental Policy Act, as a means of addressing concerns about environmental impacts in planning and decision making processes for major development projects (Gilpin, 1995; Noble, 2010). Impact assessment is the process of assessing the potential impacts of proposed projects, identifying ways to avoid or mitigate adverse impacts, and evaluating the significance of impacts in support of decisions about whether to grant or deny proposed projects permission to proceed (Baker & Rapaport, 2009). Impact assessment is recognized as one of the most prominent regulatory approaches to environmental management in North America (Hanna, 2009) and around the world (Noble, 2010). Noble (2010) notes that over 100 countries currently have an impact assessment system. In Canada, impact assessment is applied at the federal level and by every province and territory.

Impact assessment regimes in many jurisdictions around the world consider social and economic effects in addition to environmental (i.e., biophysical) effects (Noble, 2010). In the early years of regulated impact assessment practice, impact assessment was limited to assessing environmental impacts (Noble, 2010). Then, in the 1980s and 1990s, during a period of

increasing concern about social, economic, and environmental sustainability, impact assessment regimes began to direct attention at social and economic impacts (Noble, 2010) by including them in their assessments. At present in Canada, nine out of the fourteen impact assessment regimes at the federal, provincial, and territorial levels, assess economic and social impacts in addition to environmental impacts.

Impact assessment process

Over time, the impact assessment process has become institutionalized and organized into distinct stages, beginning with project proposal and leading to a project approval or rejection decision. Figure 1 shows typical stages in the impact assessment process, based on my own experience with the process and typical stages noted in the impact assessment literature (Hanna, 2009; Noble, 2010; Sadler, 1996). For projects that receive approval, the final stage, in some jurisdictions, consists of ongoing compliance verification and, if necessary, enforcement measures to ensure projects are carried out in compliance with approval conditions (Hanna, 2009). In addition, some jurisdictions monitor the actual impacts of projects during construction and operational phases to verify and learn from the accuracy of impact predictions for the purpose of identifying opportunities to improve impact assessment practices (Noble, 2010). Hanna (2009) notes that such follow up activities are relatively recent additions to the impact assessment process and that the strength of linkages between impact assessment and compliance and enforcement functions varies between jurisdictions.

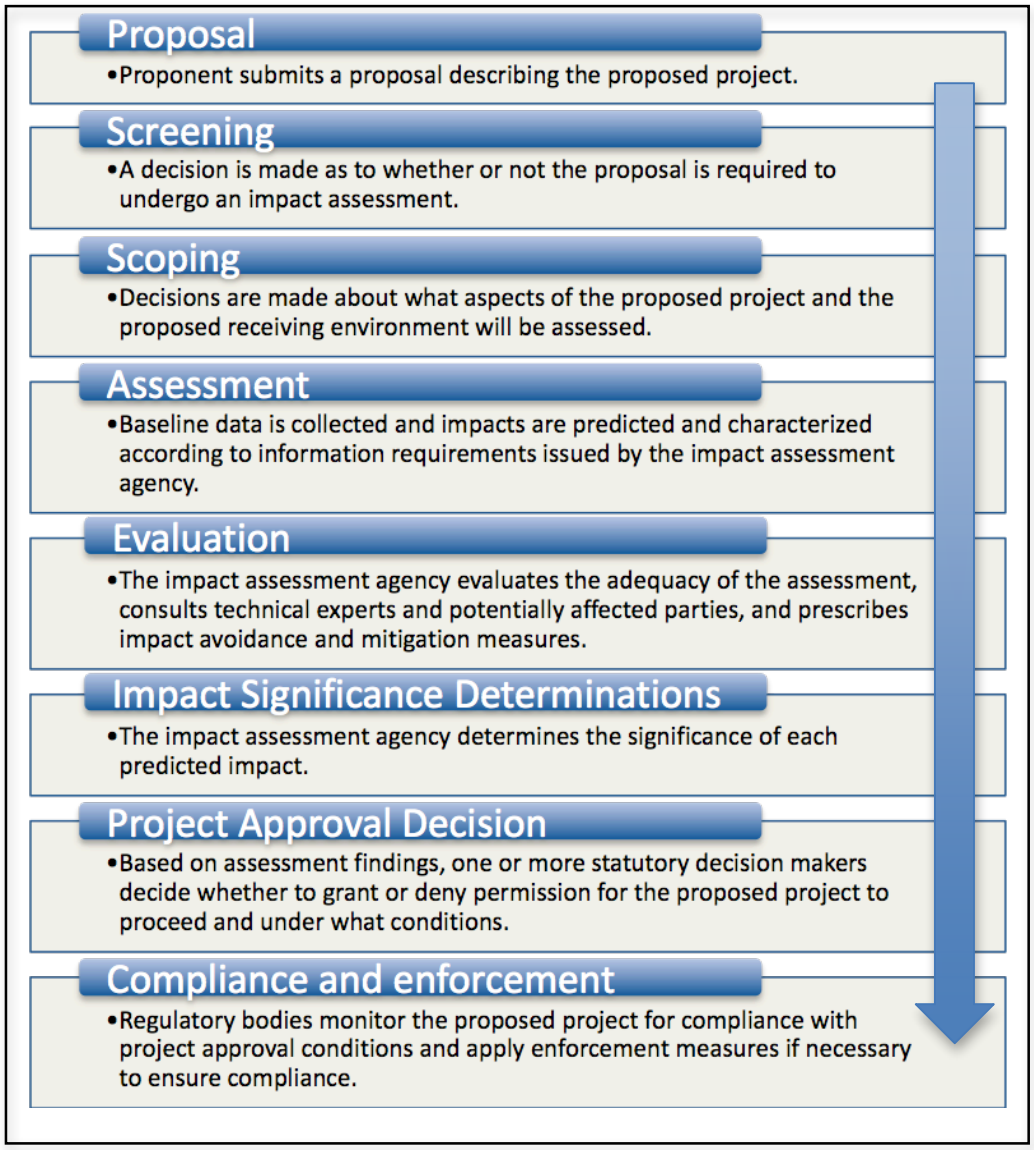

Figure 1. Common stages in the impact assessment process.

Guiding objectives and principles

Objectives and principles create a framework that guides the impact assessment process in achieving its purposes of assessing project effects, prescribing means of avoiding or mitigating adverse effects, and supporting decisions about project approval or rejection. The literature suggests several objectives and principles, which are recognized and followed to varying degrees in impact assessment systems around the world.

In a paper published by the International Association for Impact Assessment, Senecal, Sadler, Goldsmith, Brown, and Conover (1999) suggest key objectives of the process should be to address environmental considerations in decisions about proposed projects, to identify ways to avoid or mitigate environmental and social impacts, to preserve the integrity of natural systems, and to promote sustainable development. Gibson and Hassan (2005) suggest a key objective of impact assessment should be to facilitate environmental, social and economic sustainability. Guiding objectives in British Columbia are similar to these. Under the provincial impact assessment system in British Columbia, the implied objectives of impact assessment, inferred from a published overview of the process, are to provide "an integrated process for identifying and evaluating a reviewable project's potential adverse effects (environmental, social, health, heritage, and economic)", to avoid or mitigation adverse effects, and to conduct "comprehensive and efficient environmental assessments [that] result in well-informed and timely decision-making that [support] sustainable development" (EAO, 2009b, p. 10).

Guiding principles recommended by Senecal et al. (1999) suggest that impact assessment should be "purposive", "rigorous", "practical", "relevant", "cost-effective", "efficient", "focused", "adaptive", "participative", "interdisciplinary", "credible", "integrated", "transparent" and "systematic" (p. 3). These same guiding principles are also recognized and reiterated by Hanna (2009) and Noble (2010). The provincial impact assessment system in British Columbia has similar guiding principles, which are "fairness", "transparency", "inclusiveness", "comprehensiveness", and "efficiency" (EAO, 2009a, p. 9).

Together, guiding objectives and principles are intended to guide processes in each stage of the impact assessment process including what data is collected, who is engaged in the process, how findings and conclusions are arrived at and communicated, and how decisions are made. As

will be discussed later, the guiding principles of fairness, transparency, inclusiveness, and comprehensiveness are particularly relevant to how impact significance determinations are carried out and communicated.

Terminology

There are several terms that are used commonly in impact assessment to refer to the impact assessment process and related concepts. For the sake of clarity, an overview of a few key terms is provided here.

The terms *environmental assessment*, *impact assessment*, and *environmental impact assessment* are often used interchangeably to refer to the same process of identifying, and then suggesting ways to mitigate, the effects of proposed activities (Noble, 2010). This paper uses the term *impact assessment* because it more precisely describes the process than the more general term *environmental assessment.* It also more appropriately describes impact assessment regimes, such as British Columbia's, that consider other kinds of impacts in addition to environmental impacts.

Terms used to refer to stages in the impact assessment process vary between jurisdictions. Common terms that are used in some jurisdictions and in the impact assessment literature are described above in Figure 1.

The terms *impact significance determination* and *significance determination* refer to the process of evaluating and coming to a conclusion about the significance of each impact identified during the impact assessment process (Baker & Rapaport, 2009; Lawrence, 2000; Noble, 2010; Sadler, 1996). These two terms are used interchangeably in this paper and have the same intended meaning. The concept of impact significance is defined and discussed below.

Impact Significance

The concept of impact significance is at the heart of the impact assessment process (Duinker & Beanlands, 1986; Lawrence, 2007a; Wood & Becker, 2005). Impact significance has been defined in various ways, including:

- the meaning of impacts to their environmental, social, and economic settings (Sippe, 1999);
- "an expression of the cost or value of an impact to society.…based upon the value-judgements of society, or groups of people chosen to represent the wishes of society" (Thompson, 1990, p. 241);
- "experts' and stakeholders' judgment on the overall importance of" "the difference in environmental quality induced by human action" (Cloquell-Ballester, Monterde-Diaz, Cloquell-Ballester, & Santamarina-Siurana, 2007, p. 63); and,
- the importance of impacts, as "a function of the characteristics of the environmental effect or impact and the importance or value attached to the affected component" (Noble, 2010, p. 128).

From the perspective of sustainability, Gibson (2001) suggests that the concept of significance facilitates "a coming together of human and ecological concerns…resting on a set of pillars (most often social, economic and ecological) representing areas of concern often in opposition but requiring reconciliation" (p. 49).

Impact significance is recognized as one of the most critical aspects of impact assessment (Duinker & Beanlands, 1983; Lawrence, 2007a; Noble, 2010; Rossouw, 2003; Sadler, 1996) because it is central to impact assessment statutes (Lawrence, 2007a; Sippe, 1999) and it is the

basis for pivotal decisions in each of the main stages of impact assessment (Lawrence, 2000; Noble, 2010; Sadler, 1996; Sippe, 1999). It triggers the requirement for assessment (Sippe, 1999; Wood & Becker, 2005), it guides the selection of which impacts and impact receptors are assessed and mitigated (Lawrence, 2004; Wood, 2008), it is the focal point of impact assessment reports (Lawrence, 2000), and it forms the foundation of project approval and rejection recommendations and decisions (Kruger, 2009; Noble, 2010; Sadler, 1996).

Most conspicuously, significance determinations are central to screening, scoping and project approval recommendations. During screening, a decision is made as to whether a given project proposal is required to undergo assessment, based on the potential for project activities to cause significant impacts (Morgan, 1988; Ross et al., 2006; Sippe, 1999). In impact assessment practice around the world, the potential for significant adverse impacts is the regulatory basis for requiring proposed projects to undergo assessment (Sippe, 1999; Wood & Becker, 2005). During scoping, aspects of a project's proposed setting that could be subject to a significant impact as a result of the project are scoped into the assessment. During the assessment, predicted impacts are characterized and mitigation measures are devised to reduce the significance of impacts. At the culmination of the assessment, judgments are made about the significance of predicted "residual" impacts (i.e., impacts predicted to remain after impact mitigation measures are implemented). Significance determinations at this final stage of the assessment process are a key element of recommendations and decisions pertaining to project approval or rejection (Kruger, 2009; Lawrence, 2005; Sadler, 1996). For example, Lawrence (2005) notes that the central test for project approval or rejection under the *Canadian Environmental Assessment Act* (1992) is whether a project is considered likely to cause a significant adverse effect. The

analysis of EAO documents that follows is focused on impact significance determinations at this culminating stage of the impact assessment process.

Characteristics of impact significance determinations

The literature indicates impact significance determinations are subjective judgments (Baker & Rapaport, 2009; Duinker & Beanlands, 1986; Haddock, 2010; Haug et al., 1984; Lawrence, 2007a; Noble, 2010; Sippe, 1999) about the degree of importance people place on changes brought about by impacts (Gibson, 2005; Lawrence, 2005; Noble, 2010; Sippe, 1999; Thompson, 1990; Weston, 2000; Wood, 2008). Thus, as Sippe (1999) notes, significance allows for the importance people place on changes (i.e., the value based "meaning" of impacts) to be distinguished from, and considered in concert with, the characteristics of impacts.

The literature recognizes the following three main information inputs for significance determinations, which are discussed below:

- predictions about impact characteristics (Baker & Rapaport, 2009; Canter & Canty, 1993; Cloquell-Ballester et al., 2007; Lawrence, 2007a; Noble, 2010);
- information about the characteristics of a predicted impact's setting, including environmental and social dimensions, which is often referred to as impact *context* (Baker & Rapaport, 2009; Canter & Canty, 1993; Haddock, 2010; Kruger, 2009; Lawrence, 2007a; Morgan, 1998; Sadler, 1996; Wood & Becker, 2005); and,
- information about how people, including technical experts and potentially affected people, view the importance of an impact (Canter & Canty, 1993; Lawrence, 2007a; Morgan, 1998; Noble, 2010; Rossouw, 2003; Thompson, 1990).

Predicting impact characteristics in support of significance determinations is one of the most prominent functions of impact assessment. Potential impacts are characterized using a variety of techniques to make predictions about how a project could change baseline conditions in its receiving environment (Morris & Therivel, 2009). Impact characteristics commonly described in significance analyses include:

- the type of impact (e.g., adverse, beneficial, cumulative);
- the likelihood that the impact will occur; and,
- impact magnitude, geographic extent, duration, frequency, and reversibility (Lawrence, 2004; Noble, 2010).

Numerous authors indicate that in addition to impact characteristics, impact significance depends on the context within which impacts occur (Baker & Rapaport, 2009; Kjellerup, 1999; Kruger, 2009; Lawrence, 2007a; Morgan, 1998; Morris & Therivel, 2009; Noble, 2010; Rossouw, 2003; Sadler, 1996; Sippe, 1999; Weston, 2000; Wood, 2008; Wood & Becker, 2005). Impact significance is context sensitive (Lawrence, 2007a; Wood, 2008), because different settings can respond to impacts in different ways (Thompson, 1990) and the social (Kruger, 2009) and ecological (Wood, 2008) importance of impact receptors can vary from one setting to another. Lawrence (2007a) and Thompson (1990) explain that significance determinations are a means of identifying the relationship between impacts and their setting. Consequently, considerations of impact context play a vital role in significance determination (Lawrence, 2007a).

Several authors indicate that various aspects of an impact's setting influence impact significance, including ecological, social, economic, and regulatory aspects (Lawrence, 2007a; Noble, 2010; Rossouw, 2003; Sadler, 1996; Sippe, 1999; Wood, 2008). As a result, there can be

different kinds of significance, such as “ecological” significance or “social” significance. But in practice, at least in studies carried out by Duinker and Beanlands (1986) and Ross et al. (2006), the kind of significance addressed in significance determinations is often not clarified. As will be discussed later, this is also the case in British Columbia. Consequently, there appears to be an opportunity to clarify the intended meanings of significance determinations by stipulating whether significance conclusions pertain to only one kind of significance, such as ecological significance, whether they are integrated determinations that consider ecological, social, and other types of significance, or some combination thereof. Some authors have addressed this issue by recommending that significance analyses distinguish between the ecological and social importance of impacts (Duinker & Beanlands, 1983; Noble, 2010; Sadler, 1996; Sippe, 1999) so that the various perspectives of technical experts and other interested or potentially affected people can be distinguished.

Due to the varied interests of people involved in a given assessment or who may be affected by a given project, there is inevitably a plurality of perspectives involved in significance determination. Wood (2008) notes that project proponents, regulators, lay public, special interest groups, and technical specialists can have divergent views on what impacts may or may not be considered significant. As a result of the plurality of perspectives involved, significance conclusions can be contentious (Rossouw, 2003; Sadler, 1996; Wood, 2008).

To carry out well-substantiated significance determinations, information is required about the importance various people place on impacts (Kruger, 2009; Morgan, 1998; Rossouw, 2003), including technical experts and potentially affected people (Lawrence, 2007c). Morgan (1998) suggests that in the absence of such information, assessors may arrive at significance conclusions founded on their own perspectives without incorporating the perspectives of people who would

be affected by the impact. Similarly, Thompson (1990) indicates that unless public perspectives are incorporated in significance determinations, there is a risk of conclusions being unduly influenced by the perspectives of technical experts carrying out the assessment. Thompson (1990) argues that while expert judgment is necessary for identifying impact characteristics, such as impact magnitude, technical experts are not the appropriate parties to identify the importance, cost, or acceptability of an impact to society.

In my opinion, technical experts are, however, the appropriate parties to determine the technical importance of impacts, such as "ecological" or "hydrological" significance. Hence it is important for assessors to stipulate the type of significance being considered in a given significance determination, and to distinguish between different kinds of significance (Sadler, 1996).

The literature indicates impact significance determinations are subjective (Haddock, 2010; Lawrence, 2007a; Noble, 2010; Sadler, 1996) due to "the integration of the values, experiences, and knowledge of the different actors that perform the evaluation" (Antunes, Santos, & Jordão, 2001, p. 512). In keeping with impact assessment's principle of transparency, it is recommended that significance determinations explicitly address the subjectivity involved by identifying the values upon which significance judgments are made (Lawrence, 2007a; Sadler, 1996; Sippe, 1999), whose values they represent (Roussow, 2003; Thompson, 1990), and how competing values are evaluated (Kruger, 2009).

Impact significance determinations are also characterized by uncertainty (Lawrence, 2007a; Rossouw, 2003; Sadler, 1996; Sippe, 1999; Wood, 2008). Wood (2008) indicates specific sources of uncertainty include:

- predictions about impact characteristics based on limited data;

- the use of predictive methods that contain uncertainties;
- the use of predictive methods that are unsuitable and therefore yield uncertainties;
- predictions about future baseline conditions of the receiving environment, which are inherently uncertain;
- expert judgment constrained by the limits of scientific knowledge; and,
- uncertainties about the effectiveness of mitigation measures and therefore the characteristics of residual impacts.

A *First Nations Environmental Assessment Toolkit* document, developed to support aboriginal groups in participating in impact assessment in British Columbia concurs with observations in the literature about uncertainty and the varying perspectives involved, by noting that "the significance of environmental effects cannot be predicted with 100% certainty, and different groups may have different interpretations of significance" (FNEATWG, 2004, Pt. 2, p. 3). Because of the numerous sources of uncertainty and the varying perspectives and competing interests involved, conclusions about impact significance are debatable and can be the focus of differences of opinion. Consequently, significance conclusions would benefit from the support of well-reasoned and transparent arguments so that the reasons and rationale supporting conclusions are apparent.

Approaches

Approaches for evaluating significance at the regulatory and applied levels vary substantially and there is no international consensus on a standard method (Lawrence, 2005; Noble, 2010; Sippe, 1999). To highlight and help understand the characteristics of various approaches for assessing impact significance, Lawrence (2007b) categorizes impact significance

determination approaches into one or another of three classes – technical, collaborative and reasoned argument approaches – based on how significance conclusions are derived and presented. Noble (2010) concurs with Lawrence's categorization. These categorizations are a useful way of understanding various ways of determining significance. A brief overview of these categories follows, as described by Lawrence (2007b) and Noble (2010).

Technical approach

Noble (2010) reports that the technical approach is the most widely used model for impact significance determination. The technical approach uses standardized methods to evaluate impact characteristics using sets of criteria – such as impact magnitude, reversibility, probability and duration – and often employs thresholds that specify limits above which impacts are considered to be significant (Lawrence, 2007b). Technical approaches vary in complexity from simply stipulating a list of impact characteristics for evaluation, as is done in British Columbia and under Canada's federal impact assessment system, to quantitative methods that assign numerical values to predicted impact characteristics then apply mathematical procedures to aggregate results and yield overall ratings of significance (Noble, 2010; Lawrence, 2007b). The technical approach relies heavily on expert knowledge and technical analyses to determine significance (Lawrence, 2005). Quantitative analyses are preferred over qualitative analyses in an effort to achieve consistency and objectivity (Lawrence, 2007b).

The technical approach is criticized as cloaking unavoidably subjective value based judgments in apparent objectivity (Lawrence, 2007b). Baker and Rapaport (2005) explain that significance evaluation "based strictly on scientific data is inadequate in many cases because resources and ecosystems are linked with human values and cultural meaning" (p. 42). Other authors have made similar points, including Larcombe (2000), Noble (2010), Rossouw (2003),

Sadler (1996), Sippe (1999), and Thompson (1990). Based on an extensive review of research and literature pertaining to significance determination, Lawrence (2007a) indicates that significance evaluation methods "that treat the interpretation of impact significance as a task best addressed by value-free, technical, precise, simple, standardized procedures, and best undertaken by impact analysis 'experts' are inherently at odds with the nature of impact significance judgments" (p. 761). Similarly, in a report by Sadler (1996) presenting the results of an international study that examined the effectiveness of environmental assessment in several jurisdictions around the world, including Canada and British Columbia, explains that:

> The evaluation of significance is subjective, contingent upon values, and dependent upon the environmental and community context. Often scientists evaluate significance differently. The intrusion of wider public concerns and social values is inescapable and contentions will remain even with well-defined criteria and a structured approach. (p. 121)

Lawrence (2007b) indicates that while scientific knowledge and technical approaches provide essential support, they are not an adequate basis for significance determinations in the absence of contextual analyses and community perspectives. Lawrence (2007a) suggests "that significance determination procedures tend to be more effective when they are 'value-full,' non-technical (except in a support sense), adaptive, and when they involve an open, collective, iterative process that focuses on issues, is closely tied to decision-making and is sensitive to context" (p. 761). The technical approach is effective at incorporating information about predicted impact characteristics, and less effective at addressing value based perspectives and contextual analyses (Lawrence, 2007b). The aspect of argument analysis that distinguishes between fact, value, and

policy cases, and premises required for each, is relevant to help address challenges such as these, and is discussed later.

Collaborative approach

The collaborative approach to significance determination is focused on the participation of people with varying interests and perspectives concerning impacts. Lawrence (2007b) explains that those who use the collaborative approach do so based on "the premise that subjective, value based judgments about what is important should result from interactions among interested and affected parties" (p. 736). Involved groups collectively make decisions about the importance of impacts based on their own perspectives and, if they so choose, with support from technical analysis of predicted impact characteristics (Lawrence, 2007b). In contrast to the technical approach, which is a top-down approach based on expert analysis, the collaborative process is a bottom-up approach characterized by extensive public engagement, discourse, and group decision making (Lawrence, 2007b). Lawrence (2007b) reports that benefits of the collaborative approach include an ability to integrate contextual analyses and multiple perspectives, interests, and knowledge sets into significance determinations. Weaknesses of the approach can include drawn-out decision making processes and a potential for technical inputs to be overlooked (Lawrence, 2007b). Noble (2010) advises that under the collaborative approach care should be taken to distinguish between public concern about impacts and the actual impacts.

Reasoned argumentation approach

The reasoned argumentation approach is based on the premise that significance determinations are, in fact, judgments supported by evidence and reasoning (Lawrence, 2007b; Noble, 2010) even if those elements are not always made clear. Lawrence (2007b) explains that argumentation is a fundamental element of impact assessment and is "evident in all impact

assessment documents" (p. 745) in the way important issues are focused on and reasoning is provided to describe why certain issues are more worthy of attention than others. Despite the prominence of argumentation in impact assessment, little attention has been directed at how argumentation is and can be applied in significance determinations (Lawrence, 2007b). The reasoned argumentation approach involves using a structured reasoning process to sort through assessment data and analyses, to focus on information most pertinent to decision-making, and to build arguments to support and convey significance determinations (Lawrence, 2007b; Noble, 2010). Lawrence (2007b) compares the reasoned argumentation approach to the technical and collaborative approaches and describes its potential as follows:

> The reasoned argumentation approach starts from the premise that both technical and collaborative approaches are too narrow to provide an adequate foundation for value based significance judgments about what is and is not important. The technical approach is viewed as pre-occupied with technical analysis and quantification, at the expense of community perspectives and knowledge. The collaborative approach is viewed as too quickly equating public concerns and issues with impact significance, at the expense of other sources of insight and knowledge. Arguably, the reasoned argumentation approach has the potential to integrate technical and community knowledge, facts and values, multiple perspectives and both the qualitative and the quantitative information into a form (a reasoned, comprehensive and fully substantiated written and/or oral argument) that all parties can understand and jointly construct. (p. 745)

The reasoned argumentation approach provides a framework to produce and present well-substantiated, and therefore transparent, impact significance determinations in a form of communication that is familiar to a wide audience (Lawrence, 2007b). Lawrence (2007b) and

Noble (2010) suggest a potential weakness of this approach is that well-reasoned arguments can be constructed without full consideration of relevant information. Consequently, it is recommended that the reasoned argumentation approach should be guided by substantive and procedural objectives to establish a consistent reasoning process that adequately considers the various dimensions of significance, including scientific data and public perspectives (Lawrence, 2007b; Noble, 2010). As is recommended later, a consistent reasoning process can be established through guidance that specifies the types of premises that should be presented to justify significance conclusions as well-reasoned and clearly supported arguments.

Although Lawrence (2007b) and Noble (2010) identify reasoned argumentation as one of three major forms in which impact significance determinations are derived and communicated, all impact significance determinations can be considered arguments because, as will be explained in more detail later, they *are* arguments in a formal sense. That is, they consist of conclusions founded on reasoning, they are debatable and they are intended to convince an audience of the validity of the significance conclusion. For this reason, it is appropriate to communicate significance conclusions in the form of well-structured and well-supported arguments, regardless of whether significance conclusions are supported by a technical or collaborative analysis.

Composite approach

Lawrence (2007b) follows his review of three types of assessment by advocating for composite significance determination approaches, tailored to suit the specific characteristics and context of impacts being assessed. By blending aspects of the three other categories of approaches, practitioners can design context sensitive approaches that make use of strengths and avoid or offset weaknesses of each type of approach (Lawrence, 2007b). Noble (2010) suggests composite approaches can effectively combine the three main types of approaches to significance

determination by considering technical analyses, traditional knowledge, and public concerns within a reasoned argument framework. The findings and recommendations of this study concur with Noble's suggestion and provide specific and detailed recommendations on how argument can be used as a framework for significance determination. When implementing any approach, composite or otherwise, Lawrence (2007c) suggests practitioners should provide rationale to explain why a particular approach is suitable.

Challenges

Despite the fundamental importance of impact significance in the impact assessment process (Lawrence, 2004; Noble, 2010; Sippe, 1999) and 40 years of significance evaluation practice, the literature suggests significance determinations remain a problematic and challenging aspect of impact assessment practice (Haddock, 2010; Kruger, 2009; Lawrence, 2007a; Noble, 2010; Sadler, 1996). Significance determination is a complex (Noble, 2010; Wood, 2008) and imprecise task (Lawrence, 2007a), involving value-laden judgments, science based predictions, the attribution of social and cultural importance (Baker & Rapaport, 2009) and numerous sources of uncertainty (Wood, 2008). Hence, it is no wonder carrying out and communicating well-substantiated impact significance determinations is a challenging task. Numerous criticisms have been directed at how impact significance is handled at the statutory and applied levels (Lawrence, 2007a). Major challenges noted in the literature include:

- a poor understanding of the concept of impact significance at the applied level, resulting in untenable significance analyses and conclusions (Wood, 2008);
- a tendency not to define the concept in legislation or in assessments (Haddock, 2010; Kruger, 2009; Lawrence, 2000) and a tendency to provide vague or ambiguous

definitions when they are provided (Duinker & Beanlands, 1986; Lawrence, 2000; Ross et al., 2006);

- not clarifying the type of significance being evaluated (Duinker & Beanlands, 1986; Ross et al., 2006);
- favouring technical analyses at the expense of contextual analyses and societal and cultural perspectives (Lawrence, 2007a; Baker & Rapaport, 2009; Larcombe, 2000), resulting in incomplete consideration the main aspects of impact significance (Lawrence, 2007a);
- equating impact magnitude with impact significance (Lawrence, 2004, 2005, 2007a);
- a failure to address uncertainties, including assessment methodology limitations (Wood, 2008);
- a failure to disclose the measures by which significance is judged (Ross et al., 2006);
- a prevalence of findings of no significant adverse effects, which calls the legitimacy of significance conclusions into question (Ross et al., 2006); and,
- a failure to adequately substantiate significance conclusions (Haddock, 2010; Lawrence, 2007a; Ross et al., 2006; Rossouw, 2003; Wood, 2008).

Lawrence (2007a) suggests, "there is considerable room for improvement in how impact significance determination is conducted" (p. 762) and several authors offer guidance on how to improve the process.

Recommended responses

Recommended responses to noted challenges are numerous (Lawrence, 2007a) and include those of: Duinker and Beanlands (1986); Canter and Canty (1993); Cloquell-Ballester et al. (2007); Glynn (2004); Haug et al. (1984); Kruger (2009); Larcombe (2000); Lawrence (1993,

2000, 2004, 2005, 2007a, 2007b, 2007c); Ross et al. (2006); Rossouw (2003); Sadler (1996); Sippe (1999); Thompson (1990); and, Wood (2008). In keeping with impact assessment's principle of transparency, the literature indicates that a key means of improving significance determinations is to better substantiate them (Lawrence, 2004, 2007a; Sadler, 1996) so that the methods, reasoning, technical information, and judgments supporting significance conclusions are apparent and traceable (Lawrence, 2007a). As will be highlighted in the next section, argumentation provides a framework that can be used to explain the reasons and rationale supporting significance conclusions, thereby contributing to transparency.

Due to the imprecise and value-laden nature of impact evaluation, Noble (2010) suggests, with reference to Lawrence (1993), that "significance is not so much the search for objectivity as it is how well subjectivity can be substantiated" (Noble, 2010, p. 145). Consequently, several authors recommend significance determinations should be clearly substantiated so that the basis for significance conclusions is evident (Glynn, 2004; Haug et al., 1984; Kruger, 2009; Lawrence, 1993, 2005; Noble, 2010; Ross et al., 2006; Sadler, 1996; Sippe, 1999; Wood, 2008). Based on extensive research into the purpose and practice of impact significance determinations, numerous authors have recommended practices for carrying out well-substantiated impact significance determinations including, Glynn (2004), Rossouw (2003), Sadler (1996), and Sippe (1999). Concurring with the recommendations of these and other authors, Lawrence (2007c) provides a long and comprehensive list and description of good practices for impact significance determinations. Lawrence's (2007c) list of good practices suggests that impact significance determinations should be focused and efficient, "logical", "substantiated", "reasoned", "comprehensive", "systematic", "traceable", "explicit", "context sensitive", "collaborative", "value-full", "unbiased", and that impact significance determinations should integrate

community and technical knowledge, manage uncertainties, and facilitate conflict resolution (pp. 772-774). Along similar lines, Sadler (1996) recommends requirements for impact significance determinations, indicating that:

> Key requirements are to:
>
> - use a systematic approach in which the choice of method is clearly related to the problem at hand and, as far as possible, can be widely understood;
> - apply criteria that allow the attribution of significance in a rational, defensible and problem-relevant way;
> - identify the basis on which judgments are made;
> - distinguish between the ecological and social importance of impacts;
> - describe as necessary, the confidence levels in impact prediction and judgment that underlie the attribution of significance; and
> - provide a straightforward, non-technical explanation of approach (including assumptions and qualifications) when more complex methodologies are used, e.g., multi-criteria analysis. (p. 121)

Despite these recommendations, as several authors note, actual practice remains problematic, perhaps because recommendations in the literature are not being integrated into practice as fully as they could be. Many of the recommendations in the literature could be integrated into a reasoned argumentation approach to impact significance determination. As Lawrence (2007b) and Noble (2010) suggest, argumentation can incorporate information produced by both non-technical and technical forms of impact significance analysis, including fact based, value based, qualitative, and quantitative information. Argumentation is also a familiar form of communication and is therefore accessible to a wide audience (Lawrence,

2007b). As will be discussed later, a review of the argumentation literature found that the field of argumentation offers tools that can be used to guide and communicate well-reasoned impact significance determinations that can incorporate both the fact and value based types of inputs that the impact assessment literature indicates are necessary to carry out well-supported impact significance determinations.

Chapter 3: Methods

I initiated the study using a participatory action research approach so that the organization that is intended to benefit from the results and recommendations, the British Columbia Environmental Assessment Office (EAO), could participate in selecting the topic for the research. The EAO sponsored the study by helping to select the topic for the study, providing access to impact assessment information for the purposes of the study, and by providing office resources to support the research. I am an employee of the EAO, and was throughout the course of the study. I currently hold the position of Manager of Policy and Project Assessment. In addition to conducting the study, I participated in the study by contributing subject matter knowledge to the research and by collaborating with staff at the EAO to identify issues and opportunities related to the research topic. My participation in the study in these ways is consistent with a participatory action research approach (Berg, 2009; Stringer, 2007).

Specific methods used for carrying out the study are described below.

Argumentation Literature Review

The review of impact assessment literature led to observations that impact significance determinations are arguments and that in practice they tend to have several types of shortcomings that could be overcome by using the concepts and methods of argumentation. These observations led to an exploration of the argumentation literature. A review of argumentation literature was carried out to identify concepts that could be used to better understand impact significance determinations, and to identify potential methods for justifying and communicating impact significance determinations as strong arguments.

Agency Document Review

A review of legislation and agency documents was carried out to identify the roles of impact significance determination in the EAO's legislated framework, guiding objectives and principles for the EAO's assessments, and policies that guide how impact significance determinations are carried out. Observations from the document review are referred to during the argument analysis portion of the study to understand how the EAO's significance determination practices relate to statutory requirements and policy guidance. The following documents were reviewed:

- *Environmental Assessment Act* (2002);
- *Reviewable Projects Regulation* (2002);
- *Fairness and Service Code* (2009);
- *Environmental Assessment Office User Guide* (2009);
- the EAO's Assessment Report template; and,
- a sample of 11 Assessment Reports written and published by the EAO.

Argument Analysis

One way to explore impact significance is to examine how impact significance determinations are presented and substantiated in impact assessment documents. As will be discussed later, argument analysis is a systematic way of doing this, by assessing the extent to which impact significance determinations are justified as strong arguments. Consequently, I chose to analyze the arguments presented in a sample of significance determinations published by the EAO.

I selected an argument analysis approach for four reasons. First, impact significance determinations are arguments (Brown, 2011; Lawrence, 2007b). That is, impact significance determinations are conclusions based on premises, they are formulated for and communicated to an audience, and they are debatable. Impact significance determinations are debatable because, as discussed previously, they are subjective value based judgments about the importance or gravity of impacts. They are also debatable because they are based on predictions about impact characteristics that have inherent uncertainties, as was also previously discussed. Second, argument analysis is a recognized method for assessing and identifying ways to improve argument structure and strength (Brown, 2011; Gasper & George, 1998). Third, as discussed above, the impact assessment literature indicates that impact significance determinations are often not well-substantiated (Haddock, 2010; Lawrence; 2007a; Ross et al., 2006; Rossouw, 2003; Wood, 2008). Argument analysis is an appropriate means of verifying this observation because it is a means of assessing how well conclusions are substantiated by strong arguments that explicitly and comprehensively explain the reasons and rationale supporting conclusions. Fourth, an argument analysis approach was selected to position this study within an apparent gap in the research on impact significance, identified by Lawrence (2007b), with respect to the

application of the tools of argumentation in impact significance determinations. Specifically, Lawrence (2007b) indicates that "reasoned argumentation" is a flexible and advantageous means of substantiating and communicating impact significance determinations, but little attention has been directed at how the field of argumentation is and could be applied in impact significance determinations. Lawrence (2007b) and Noble (2010) also suggest argumentation is an appropriate framework for carrying out composite approaches to impact significance analysis that are promoted by both Lawrence (2007b) and Noble (2010) for their ability to accommodate both technical and value based types of data.

The argument analysis examined a sample of impact significance determinations drawn from a selection of 11 "Assessment Reports" written and published by the EAO. Assessment Reports are the means by which, pursuant to the *Environmental Assessment Act* (2002), the EAO conveys its impact assessments for proposed projects to provincial cabinet ministers responsible for deciding whether to grant or deny permission for proposed projects to proceed. Assessment Reports are also intended to convey the EAO's assessments to proponents, the general public, First Nations, other government agencies, and any other interested party. In keeping with impact assessment's principle of transparency, Assessment Reports are made publicly available on the EAO's website so that any interested parties can access and read them.

The data for Assessment Reports are drawn from information gathered and analyzed during the impact assessment process. Sources of data for each assessment include:

- impact assessment studies carried out by qualified professionals on behalf of proponents;
- analyses submitted to the EAO by local, provincial, and federal government agencies; and,

- input from aboriginal groups, members of the general public, and other interested or potentially affected parties.

The bulk of each Assessment Report consists of assessments of every impact that was evaluated during the impact assessment process, including the EAO's analyses of and conclusions on the significance of each impact. The other main elements of Assessment Reports are descriptions of: the proposed project under assessment; the impact assessment process and methodology; the impact assessment studies carried out; and, consultations undertaken with aboriginal groups, the public, and other parties.

The EAO began using its current method for impact significance determinations in approximately May of 2009. This argument analysis only examined the EAO's current method so that the analysis could identify opportunities to advance the EAO's current impact significance methods. I examined all 11 of the Assessment Reports that use the EAO's current method, that were completed when I started the analysis.

The argument analysis method was designed following recommendations of Gasper and George (1998) who recommend integrating and tailoring the widely recognized argument analysis methods of Scriven (1976) and Toulmin (1958) to suit the structure of the particular arguments being analyzed. Gasper and George (1998) offer several tools and suggestions and recommend drawing upon them as appropriate to apply directly to a given analysis. To customize the Gasper and George (1998) approach to an analysis of EAO reports, I first needed to identify the basic structure of the EAO's impact significance arguments. To do this, I reviewed all 11 eleven assessment reports to identify the general locations and structure of the arguments. I found that impact significance arguments are presented in distinct sections of each Assessment Report dedicated to impact significance determinations. I refer to these report

sections as *significance cases* because they convey the EAO's impact significance arguments. I also found during this initial scan that most impact significance cases use the same argument structure, which consists of six sub-arguments (hereafter referred to as *subcases*) that explore a standard set of factors pertaining to impact characteristics and impact context.

To gain a better understanding of the argument structure used by the EAO, I randomly selected four significances cases from among those in one assessment report. Following methods identified in the argumentation literature, which are discussed later, I drew Toulmin Model diagrams (Toulmin, 1958) to represent the premises and conclusions of the arguments. Then, following the suggestions of Gasper and George (1998), I expanded and modified the Toulmin Model diagrams so the diagrams would also show the subcases that the EAO presented within each significance case. This step resulted in a diagram format that displays the EAO's impact significance conclusions, supporting subcases, and the premises and conclusions presented in each subcase. The diagram format is illustrated in Figure 6 on page 65. Thus, I created a Gasper and George (1998) type argument analysis tool that summarizes and compiles information about EAO's typical impact significance arguments in one place. This tool allowed me to observe and evaluate the structure, content, strengths, and limitations of the arguments that make up a significance case. I used this mechanism to identify and organize the types of information that I collected and evaluated during the subsequent argument analysis.

After I had identified the general structure and content of the EAO's impact significance arguments I evaluated the strength of the arguments presented in a sample of three impact significance cases from each of the 11 reports, for a total sample size of 33 cases. For each sample, 41 different kinds of information were assessed, yielding a total sample of 1353 elements of the sampled impact significance cases. Appendix 1 presents a sample of raw data

collected during the analysis, showing the 41 different kinds of information that were collected for each impact significance case.

The purpose of the analysis was to assess, from an argumentation perspective, the effectiveness of the method the EAO uses for impact significance determinations, rather than to comprehensively assess variations within each report. If the purpose of the analysis was to carry out a comprehensive assessment of variations within each report, a sample size of three cases per report may not have been sufficient. However, this was not the purpose of the analysis. I believe that a sample of 33 cases from the 11 Assessment Reports that use the EAO's current impact significance determination method is a sufficiently large sample to reveal systemic strengths and limitations relating to the extent to which impact significance determinations are justified as strong arguments.

To avoid potential biases in how I selected cases for the sample, I used a random selection method to select three significance cases from each of the 11 Assessment Reports. Significance cases were randomly selected using a spreadsheet function to randomly generate three page numbers within each report. Significance cases that are concluded on these page numbers were selected for analysis. In instances when a random page number did not contain a significance conclusion, the significance case that concluded on the page nearest to and less than the random page number was selected.

The method of the analysis consisted of evaluating argument strength using seven tests derived from the argumentation literature. Toulmin Model diagrams were not used during this phase because the arguments in the sampled cases are brief and well-organized, making conclusions and premises (i.e., reasons supporting conclusions), or lack of premises, readily discernable, thereby negating the utility of summarizing the arguments in diagrammatic format.

During the evaluation I made judgments using a level of scrutiny that I believe would be characteristic of a technically informed, critical and fair-minded audience. That is a standard presumed for argument analysis (Rieke, Sillars, & Peterson, 2005).

The tests I used during the evaluation are presented and described as follows.

1. *Is the significance determination method described and is rationale provided to justify the method used?* This test was derived from Lawrence (2007c), who suggests that impact significance determinations methods should be described and justified. Such explanations are important so that readers of impact significance arguments are aware of the method used to evaluate significance and why the method is considered to be valid. This test consisted of reviewing each Assessment Report to determine whether this information is presented.

2. *To what extent are the intended meanings of key terms explicitly clarified to avoid potential problems with vagueness and/or ambiguity?* This test was included in the analysis because a feature of strong arguments is that they clearly stipulate the intended meanings of terms that play important roles in conveying the meanings of premises and conclusions (Brown, 2011; Rieke et al., 2005; Scriven, 1976). This test consisted of determining the extent to which the intended meanings of key terms used in conclusions and premises are clarified. Terms were considered to be "key" if the premises or conclusions of the case in which they occurred would be unclear if the intended meaning of the term was not clear. Two categories of key terms were reviewed: terms that identify the concept being concluded on, such as the terms *significant* and *magnitude*, and descriptive terms, such as *high* and *low*, that are used to describe characteristics of the concept being concluded on. Table 1 lists key terms that were assessed during this part of the analysis.

Table 1

Key Terms Assessed in the Sampled Impact Significance Cases

Conclusion Terms	**Descriptive Terms**
Significance	minimal, low, negligible
Magnitude	small, negligible, low, moderate, high
Geographic extent	regional, local, project footprint
Duration	short term, medium term, long term
Frequency	infrequent, intermittent, sporadic
Probability	low, moderate, high
Reversibility	reversible
Context	disturbed, undisturbed, developed, undeveloped

3. *Are premises provided for conclusions?* This test was selected because a fundamental feature of strong arguments is that they present premises to explain the reasons supporting conclusions (Brown, 2011; Govier, 2005; Scriven, 1976; Toulmin, 1958; Zarefsky, 2005). This test consisted of determining whether premises are provided in support of conclusions, including impact significance conclusions and conclusions presented in subcases for the EAO's impact significance factors (i.e., impact probability, magnitude, geographic extent, reversibility, duration, frequency, and context). For me to class premises as acceptable enough to be evaluated, information presented as premises had to be explicit enough that the specific reasons or rationale supporting a conclusion would be evident to a reader. Thus, general references to volumes of supporting information, such as "the application" or "working group input", were not accepted as constituting explicit premises unless the impact significance case indicates where specific premises are located in such volumes of information.

4. *To what extent are significance conclusions supported by premises?* This test was included because strong arguments present premises that explicitly and comprehensively support their conclusions (Brown, 2011; Govier, 2005). This test consisted of making judgments about the extent to which premises explicitly and comprehensively explain why a given impact is

deemed to be significant or not. These judgments were based on the following three tests, which are based on Govier (2005):

4.1. *To what extent are premises acceptable?* This test consisted of determining the extent to which lines of reasoning are presented that would be reasonable for a technically informed, critical, and fair-minded audience to view as believable and plausible, and therefore acceptable. I deemed premises to be acceptable if I determined that it would be reasonable for technically informed, critical, and fair-minded reader to determine that they met conditions of acceptability identified by Govier (2005). As will be discussed later, Govier (2005) indicates conditions that can render acceptable premises include when premises are logically certain, common knowledge, or are supported by cogent arguments, convincing arguments from authority, or plausible arguments of cause and effect.

4.2. *To what extent are premises relevant?* This test consisted of determining the extent to which premises clearly support ensuing significance conclusions. To assess the relevance of premises it was determined whether premises provide information in relation to the impact characteristics and contextual considerations outlined in the EAO's significance analysis method. In addition, any further information about predicted impact characteristics, impact context, or various parties' perspectives on the significance of the impact (i.e., the value basis for significance judgments) was considered to be relevant because these three types of information are identified in the impact assessment literature as being premises for impact significance conclusions. Warrants were deemed to be necessary in cases where it is not evident why premises offer relevant support for a given significance conclusion.

4.3. *To what extent are premises sufficient?* Sufficiency was assessed by identifying the extent to which premises, when considered together, offer enough support to reasonably expect

that a technically informed, critical, and fair-minded audience would accept the associated conclusion (Govier, 2005). As discussed previously, the impact assessment literature indicates there are three main types of premises required for significance determinations, which consist of information about:

- impact characteristics;
- characteristics of impact settings (i.e., impact context); and,
- people's perspectives on the importance of impacts.

To be considered sufficient, adequate information pertaining to each of these factors had to be present so that, when considered together, conclusions would be sufficiently justified.

Data from each of these tests were recorded in a spreadsheet so that a comparative and cumulative analysis of the samples could be carried out. Incidental observations and explanatory comments were also recorded in the spreadsheet.

Chapter 4: Results and Discussion

Argumentation Literature Review

As noted previously, the review of impact assessment literature led to an observation that impact significance determinations are arguments. This observation led to a review of argumentation literature to identify ways of better justifying impact significance determinations as strong arguments. The following discussion introduces the field of argumentation and demonstrates that it offers tools that can be used to guide and communicate well-reasoned impact significance determinations that can incorporate both the fact and value based types of inputs that the impact assessment literature indicates are necessary to carry out well-supported impact significance determinations.

The word *argument* is often used to refer to communication characterized by conflict and charged with emotion. This study is not concerned with that form of argument. Rather, this study focuses on argument as an organized process of reasoning. This form of argument is pervasive in everyday communication. It is evident in informal conversation, as well as in academic and professional communication, in the way reasons are provided to support conclusions. Similarly, it is evident in impact assessment.

Lawrence (2007b) indicates that argument "is a major element of the conceptual foundation of" (p. 745) impact assessment and is used throughout impact assessment documents. Lawrence (2007b) notes argument "is present in [impact assessment] documents in the document structure, in the values applied to evaluate choices and impacts, and in how relevant inputs are linked, synthesized and summarized in support of interpretations and conclusions" (p. 745). Argument is also evident in impact significance determinations, which present arguable conclusions on impact significance based on sets of stated, and unstated, premises. Yet, the arguments presented in impact assessment documents, like arguments offered in other professional contexts and in everyday conversation, are often incomplete, flawed, or poorly substantiated (Brown, 2011).

Lawrence (2007b) suggests that although argument forms part of the conceptual foundation of impact assessment, little attention has been directed at "how this tradition is and should be expressed in judgments regarding impact significance" (p.745). The literature on argumentation offers a wealth of knowledge on how to build strong and well-organized arguments that could be drawn upon to produce arguments that facilitate clear and well-justified communication of the premises supporting impact assessment conclusions. The literature review presented here provides an overview of the major characteristics of argumentation and highlights

some of the features of strong arguments. These ideas underlie both the data analysis and the conclusions that follow.

Argument can be defined as "the rational, organized presentation of evidence with the purpose of fairly convincing another person or persons to accept a conclusion that is not immediately obvious or about which there is some degree of incomplete understanding, confusion or disagreement" (Brown, 2011, p. 6). This definition makes reference to two components of argument: reasons and conclusions. It also highlights that arguments involve persuasion, an audience, and uncertainty. Audience is a fundamental element of argumentation. The purpose of argument is to persuade an audience to decide that an argument's claims are acceptable (Inch & Warnick, 2009; Rieke et al., 2005; Zarefsky, 2005). Without an audience there is no need for argument because there is no one to convince. Likewise, without uncertainty there is no need for argument (Zarefsky, 2005). In defining the characteristics of argumentation, Gasper and George (1998) explain that in an argument "a key aspect of a conclusion is that it is debatable" because "two or more positions may be taken on the issue" and "this necessitates the argument" (p. 369). If an audience does not view a claim as uncertain or debatable and is willing to accept a claim without any supporting reasons, then there is no need to present an argument.

The literature on argumentation is extensive. The study of argumentation dates back at least 2300 years to Aristotle, who theorized about deductive reasoning (Brown, 2011; Zarefsky, 2005). Deductive reasoning, which is now considered part of the field of formal logic, is a form of argument in which an argument's conclusions "always…follow with necessity from the premises" of the argument (Brown, 2011, p. 10). That is, the conclusion of a correctly made deductive argument does not contain anything that is not already established by the conclusion's supporting evidence (Zarefsky, 2005). During the centuries since Aristotle, scholars were

primarily concerned with deductive reasoning, offering differing perspectives on how to explain and characterize it (Brown, 2011; Inch & Warnick, 2009).

Then, in the mid-twentieth century, the study of argumentation shifted its focus to inductive reasoning (Brown, 2011). It is likely that the contemporary study of argument is largely focused on inductive reasoning because, unlike deductive reasoning, it is a model for everyday argumentation (Zarefsky, 2005), in both conversational and professional communication. The kind of persuasion and argument that most people use, most of the time, is inductive reasoning (Brown, 2011). Inductive reasoning differs from deductive reasoning in that the conclusion of an inductive argument puts forth information not present in the evidence supporting the conclusion (Brown, 2011; Zarefsky, 2005). The conclusion of an inductive argument follows from its supporting evidence with some degree of probability, but is not certain. Thus, inductive reasoning puts forth assertions "about matters that could be otherwise" (Zarefsky, 2005, p. 6). This type of reasoning is prevalent in common and professional arguments and is the focus of this literature review because impact significance determinations are inductive arguments. Impact significance determinations are inductive arguments because, as discussed previously, they put forth conclusions that do not necessarily follow with certainty from supporting evidence, and are therefore debatable. Consequently, this paper explores several features of inductive argument that are needed to show how it is used in this study as a tool to better understand the impact assessment process and impact significance. A discussion of classical perspectives on argumentation, including formal logic, rhetoric and dialectic, is not presented in this paper.

Argument structure

In his 1958 text, *The Uses of Argument*, Stephen Toulmin took a major step in creating the approach to argumentation that is now called "informal logic" by inventing a framework to explore the complicated, inductive reasoning of ordinary conversation (Brown, 2011). He asked, "what, then, is involved in establishing conclusions by the production of arguments?" (Toulmin, 1958, p. 89). In answer to this question, Toulmin (1958) identified the basic building blocks of argument and presented a generic schematic to represent them, now known as the Toulmin Model (Figure 2). Toulmin (1958) established that arguments consist of distinct components arranged to substantiate claims. The basic components of argument introduced by Toulmin (1958) are widely recognized in the argumentation literature. Five of these components – which he called grounds, claims (which this paper refers to as *conclusions*), warrants, backing, and qualifiers – are described below.

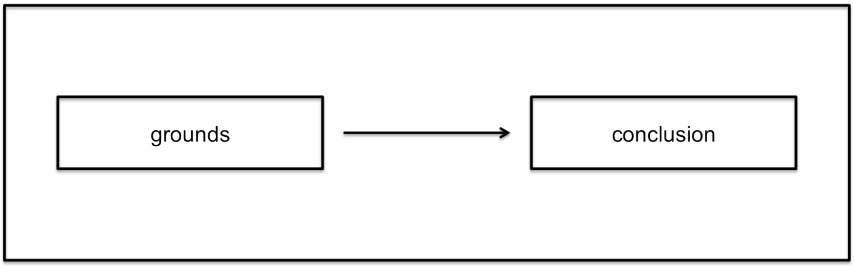

Figure 2. Toulmin Model style diagram, representing the two main components of an argument.

Most obviously, an argument consists of two components: a conclusion and supporting grounds (Figure 2) (Brown, 2011; Govier, 2005; Toulmin, 1958; Zarefsky, 2005). A conclusion is a statement that an arguer wants an audience to accept (Rieke et al., 2005). Other terms used to refer to grounds include reasons (Zarefsky, 2005), evidence (Zarefsky, 2005), and data (Toulmin, 1958). Grounds are intended to demonstrate to an audience why the arguer believes a claim is acceptable (Rieke et al., 2005). Thus, argumentation moves from "the known to the

unknown" by using statements that an audience is likely to accept (grounds) to support statements (conclusions) about the unknown that an audience is unlikely to accept in the absence of grounds (Zarefsky, 2005, p. 6). For example, an argument about impact characteristics in an impact significance case could conclude that the magnitude of rainbow trout habitat loss in a river is predicted to be low (Figure 3). The grounds for this conclusion could be that the habitat that would be lost constitutes approximately 30% of the critical habitat available in one reach of the river (Figure 3).

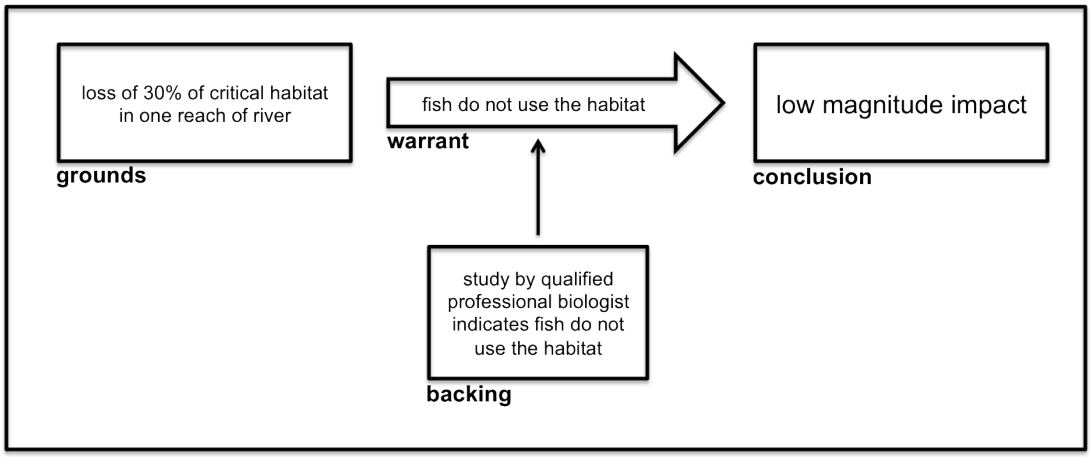

Figure 3. Toulmin Model style diagram representing an argument's grounds, warrant, warrant backing, and conclusion.

In some cases it may not be evident why certain grounds support a given conclusion. In such cases, a *warrant* can facilitate the inferential leap from grounds to conclusion by demonstrating why the grounds support a conclusion (Zarefsky, 2005). In the example above, it is not entirely evident why a loss of 30% of critical habitat is deemed to be a low magnitude effect. A warrant could be the explanation that the critical habitat in question is capable of functioning as spawning habitat but that the rainbow trout population in the river does not use it (Figure 3).

In instances where the legitimacy of grounds or warrants is, or could be questioned, *backing* can be provided to explain why the arguer believes the audience should accept the grounds or warrants (Rieki et al., 2004). For example, the warrant above consists of an unsupported claim that could be justified by providing backing. Backing for this warrant could be that a study carried out by a professional fisheries biologist indicates that rainbow trout are not known to use the habitat in question for spawning (Figure 3).

The entire body of information supporting a conclusion, including grounds, warrants, and backing, is referred to as *premises* by some authors, such as Govier (2005) and Brown (2011), and in this paper. It is evident in the example above that the premises of an argument do not obligate a conclusion with certainty. For example, even with consideration of the warrant and backing provided for the example above, it could be argued that the magnitude of the impact should be ranked as moderate rather than low because 30% is a substantial portion of critical habitat in a given reach and the rainbow trout population may use that habitat in the future due to unforeseen changes to other spawning habitat in the river. In cases where the arguer is not absolutely certain of the conclusion or wishes to temper the conclusion's applicability, *qualifiers* can be used to temper the strength or applicability of the conclusion (Gasper & George, 1998; Toulmin, 1958). For example, in the warrant example presented above the arguer could qualify the statement "the rainbow trout population in the river does not use the habitat" by adding the qualifier *likely* to argue that rainbow trout "*likely* do not" use the habitat (Figure 4). Such a qualifier could lend credibility to the argument by suggesting that it is possible that rainbow trout could use the habitat, even though, as the backing for the warrant indicates, they are not known to.

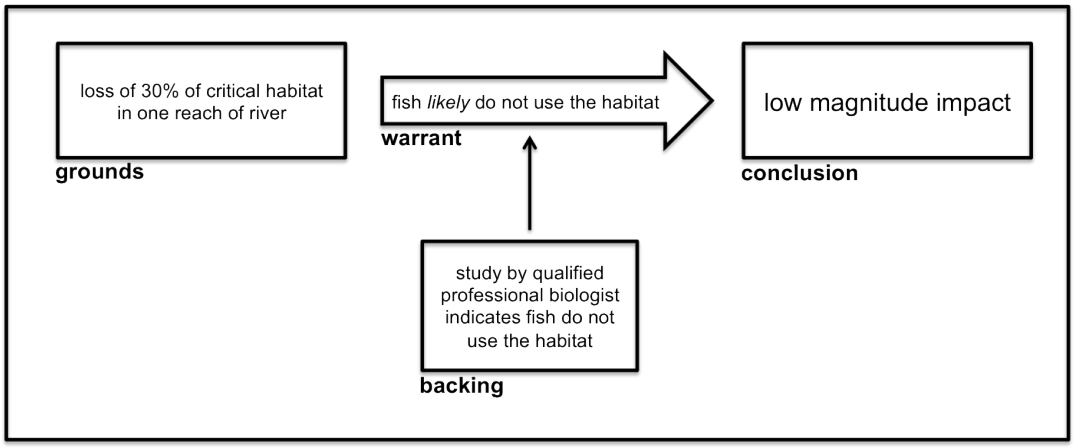

Figure 4. Toulmin Model style diagram showing the use of a qualifier and representing an argument's grounds, warrant, warrant backing, and conclusion.

Brown (2011) notes that arguments, including those presented in impact assessment documents, are often incomplete, due to the absence of certain premises. Brown (2011) also indicates that many people leave out parts of their arguments unintentionally, through error, or by not recognizing some of their implicit assumptions. Depending on the audience's knowledge and the degree of certainty associated with an argument's claims, some of the basic components of argumentation can be omitted without compromising an argument's effectiveness (Inch & Warnick, 2009). For example, some premises can be implied, rather than stated, without detracting from the completeness of the argument in situations where it can be assumed they are already accepted by the audience (Inch & Warnick, 2009). For instance, a claim stating that local greenhouse gas emissions contribute to global climate change would be accepted many people in the absence of explicit premises. If an audience is composed of people who are not apt to know the premises for this claim then it would be necessary to provide premises to explain why local emissions contribute to global climate change. In other cases, unintentionally or deliberately omitted premises can undermine the strength of an argument if the audience is either not aware of unstated premises or does not accept them.

Argument "structure" refers to how the arguer organizes the reasons, or premises, an arguer thinks are necessary for the audience to accept a conclusion. Argument structure can be simple, consisting of a single conclusion with a supporting premise. But more often, arguments have a complex structure, consisting of numerous subsidiary conclusions combined to form a *case* that puts forth a capstone conclusion (Figure 5). This overall conclusion is the ultimate conclusion an arguer wants an audience to decide to accept (Inch & Warnick, 2009). In a complex argument, the ultimate conclusion is supported by numerous sub-conclusions, each of which may be supported by a *subcase* (Figure 5). As Figure 5 illustrates, subcases are the premises for a case's overall conclusion. Each subcase may consist of numerous other conclusions and supporting premises.

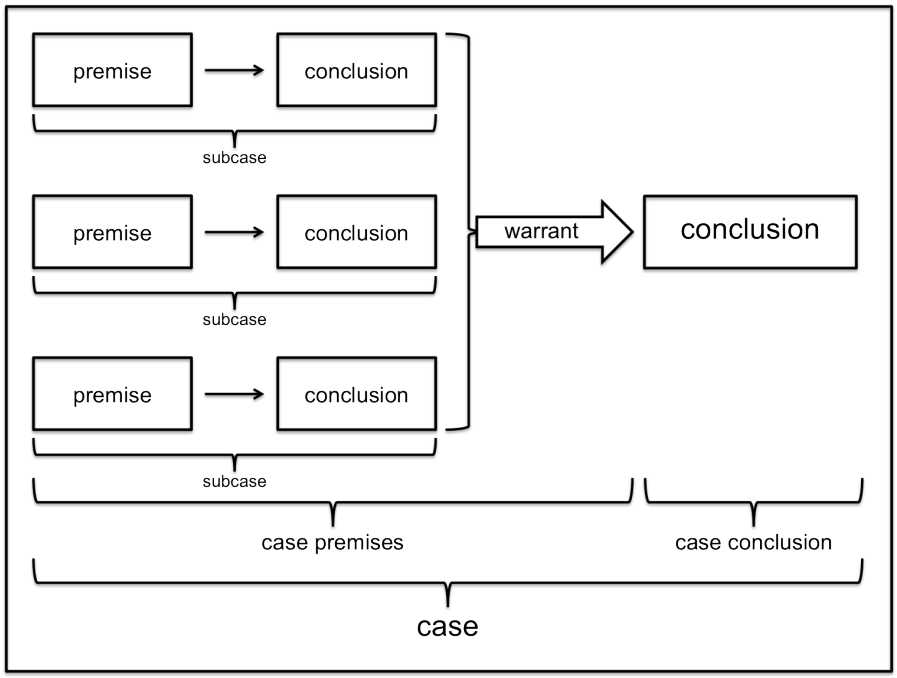

Figure 5. Complex argument structure, showing subcases that act as premises for an overall case conclusion.

An impact assessment is a complex argument culminating in a conclusion about whether or not any significant impacts are predicted to result from a proposed project. This ultimate

conclusion of an impact assessment, which leads to a decision about whether or not to allow the project to proceed, is supported by sub-arguments about the significance of each impact assessed during the impact assessment process. Each impact significance conclusion is based, explicitly or implicitly, on a complex argument about the various factors that have a bearing on impact significance, such as impact characteristics, impact context, and people's perspectives on the importance of impacts. The subcases that are made within each impact significance determination, for example, about each individual significance factor, are typically also composed of complex arguments presenting the conclusions of baseline data analyses and impact predictions. It is these central kinds of impact significance arguments that are analyzed in detail, below.

Strong arguments

Brown (2011) defines a strong argument as one that "is very convincing" (p.14). Rieke et al. (2005) indicate the purpose of argumentation is to gain the "adherence" of an audience (p. 4). Adherence is defined as an audience granting their informed support for an argument's conclusion, to the extent that they are willing to act (e.g., make a decision) based on the argument (Rieke et al., 2005). Thus, a strong argument can be defined as an argument that is sufficiently convincing to gain the adherence of an audience. The literature identifies features that can strengthen arguments. The features discussed below are features that could be brought to bear in arguments about significance.

Features that contribute to building strong arguments include providing comprehensive premises to support conclusions, using different and supportive lines of reasoning, and using clearly defined terms. Presenting premises in a clear and organized way can also contribute to argument strength. An effective way to do this is by separating, and thus making more

understandable, the types of premises that contribute to fact, value, and policy arguments, which are discussed below. Finally, avoiding weaknesses, such as implied or missing premises and errors in reasoning, also contributes to argument strength.

Explicit and comprehensive premises

A major of feature of strong arguments is that they present their premises clearly, comprehensively, and in an organized way (Brown, 2011; Govier, 2005). In addition, Govier (2005) advises that strong arguments present premises that are "acceptable" and offer "relevant" and "sufficient" support for conclusions. In the absence of premises, unless the premises are common knowledge, it would be unreasonable to expect an audience to grant adherence to an argument's conclusions. "Acceptable" premises are premises "that it would be reasonable for the person to whom the argument is addressed to accept" (Govier, 2005, p. 132). Explained in another way, if a reader believes a premise, that reader accepts the premise (Govier, 2005). Govier (2005) indicates that conditions that can make a premise acceptable include when a premise is: supported by a "cogent" sub-argument (i.e., an argument consisting of conclusions supported by acceptable, relevant, and sufficient premises); logically certain; common knowledge; supported by reliable testimony; or, is supported by an appropriate subject matter expert. Different *lines of reasoning* can be used to establish acceptable premises. Lines of reasoning, also known as *lines of argument*, are series of premises that construct links between premises and conclusions, thereby explaining to a particular audience why certain premises support a given conclusion (Inch & Warnick, 2009). It is the separate lines of reasoning that create the structure of an argument, which was discussed previously. Common types of lines of reasoning include arguments from authority (Rieke et al., 2005), common knowledge (Govier,

2005), generalization (Rieke et al., 2005; Zarefsky, 2005), and cause and effect (Rieke et al., 2005; Zarefsky, 2005).

On the topic of "relevant" premises, Govier (2005) indicates that relevant premises are those that provide a reason that clearly supports a conclusion. If the reason why a premise offers relevant support for a conclusion is not entirely evident, a warrant can be provided to explain why the premise supports the conclusion (Zarefsky, 2005).

In relation to premise "sufficiency", Govier (2005) indicates that premises are sufficient when, considered together, they offer enough support for an audience to accept the associated conclusion (Govier, 2005).

The acceptability, relevance, and sufficiency of premises collectively contribute to the extent to which conclusions are supported. However, it is important to note that each of these characteristics is independent of the others. So, a premise can be acceptable (i.e., plausible and believable), but it may not be relevant to the conclusion it is intended to support, or sufficient on its own to convince an audience to accept the conclusion.

Defining terms

Another important feature of strong arguments is that they clearly stipulate the intended meanings of terms that play important roles in conveying the meanings of premises and conclusions (Brown, 2011; Rieke et al., 2005; Scriven, 1976). Key terms are frequently vague and ambiguous (Brown, 2011; Rieke et al., 2005). Scriven (1976) notes that the imprecision of language constrains the effectiveness of argumentation when the intended meanings of key terms are not defined. When parties to an argument are not clear on the meanings of key terms, the intended meaning of the argument is unclear. Thus, strong arguments provide definitions, or other types of clarification, to "make vague terms more precise" (Zarefsky, 2005, p.33) so that

the audience can understand how key terms are being used (Little, Groarke, & Tindale, 1989), thereby eliminating, or at least narrowing, the gap between an audience's interpretations and the meanings the arguer seeks to convey (Rieke et al., 2005). The term *significant* is an example of a fundamental term at the heart of impact assessment that is both vague and ambiguous (Duinker & Beanlands, 1986) and is often not defined (Haddock, 2010; Kruger, 2009; Lawrence, 2000).

Fact, value and policy cases

Presenting arguments in an organized way can contribute to argument strength by making conclusions and premises readily apparent to an audience. Clearly distinguishing and organizing conclusions and premises can also help the arguer to determine whether premises have been provided in support of conclusions. One way to more clearly understand the purpose, content and types of premises that offer support for different arguments is to categorize them as cases of fact, value, or policy (Brown, 2011; Inch & Warnick, 2009; Rieke et al., 2005; Zarefsky, 2005). Fact cases are descriptive, value cases are evaluative judgments, and policy cases are prescriptions for action (Inch & Warnick, 2009; Rieke et al., 2005; Zarefsky, 2005). That is, fact cases present conclusions about what was, is, or is predicted to be (Inch & Warnick, 2009). Value cases present conclusions that are evaluative judgments, such as judgments about the merit, worth, or importance of something, someone, or an idea (Inch & Warnick, 2009; Rieke et al., 2005; Zarefsky, 2005). Policy cases present conclusions about what kinds of steps or actions should be taken in future (Inch & Warnick, 2009; Rieke et al., 2005). Brown (2011) notes that it is useful to distinguish between these three types of claims because the grounds required to support each are different.

A fact case provides conclusions about observable conditions that can be verified by means of data collection (Rieke et al., 2005). For example, "bull trout spawn in this river" is a

fact based conclusion that can be verified through observation. Similarly, in the impact assessment process, conclusions about predicted impact characteristics are fact based conclusions. However, they can only be verified in future, once impacts have occurred. Fact cases can stand alone in an argument, without the support of value or policy statements (Brown, 2011).

Value cases are evaluative judgments (Zarefsky, 2005). Unlike fact cases, cases of value cannot be verified by through measurement (Rieke et al., 2005). Impact significance cases are examples of value cases because they are evaluative judgments about the importance of predicted impacts. Zarefsky (2005) and Brown (2011) note that value cases can present absolute or comparative conclusions. For example, the statement "caribou are important" is an absolute value conclusion. The statement "caribou are more important than moose" is an example of a comparative value conclusion. Brown (2011) notes that value cases are crucial elements of many arguments but are often unstated, and are often assumed to be understood by an argument's audience. Omitting value cases from an argument can detract from the effectiveness of an argument, particularly when they are the premises for other conclusions in an argument. Like fact cases, value cases can stand alone, without necessarily requiring support from other cases.

Policy cases are statements about what actions the arguer believes should take place, such as how people should behave, what process should be followed, or what decisions should be made (Rieke et al., 2005). Rules, laws, and regulations are examples of policy cases (Rieke et al., 2005). Unlike cases of fact and value, policy cases cannot stand alone. Policy cases require fact and value cases as inputs. For example, the concept underpinning impact assessment legislation around the world is a policy case that says, "proposed development projects having a

potential to cause significant adverse effects should be subject to impact assessment before being permitted to proceed." This policy case is based on at least one fact premise and one value premise. A fact premise underlying impact assessment legislation is, "development projects impact their receiving environments." An underlying absolute value premise is, "the integrity of the environment is important." Thus, the fundamental policy case underlying impact assessment legislation identifies a factual condition, makes a value conclusion about that condition and prescribes an action based on the fact and value conclusions. The action suggests, "impact assessment should be used to protect the integrity of the environment from project effects that could be exceptionally adverse."

As with many value premises underlying policy and value cases, the value premise example noted above, "the integrity of the environment is important", is implied by the policy case but is not usually stated outright. In some instances the strength of a policy or value case can be undermined if supporting value premises are missing or not explicit (Brown, 2011). This can be true for unstated value premises that are not readily apparent to an audience or are unlikely to be accepted by an audience in the absence of an explicit presentation of the value premises supporting a value case. Impact significance determinations are examples of value cases that an audience may not think are worthy of acceptance in the absence of explicitly stated value premises supporting the significance judgment. This is because, in the absence of explicit value premises, the reader of an impact significance case is unlikely to be aware of the value based rationale the arguer used to arrive at the significance conclusion.

Summary

The features of strong arguments discussed above can be used to produce thoroughly justified and convincing impact significance arguments that present clearly communicated, well-

organized, and comprehensively supported impact significance cases. The impact significance literature and the argumentation literature can both be drawn upon to identify the types of data that are required to present comprehensive and explicit premises for impact significance determinations. Specifically, as discussed previously, the impact assessment literature indicates three main types of premises for evaluating impact significance. In light of the fact, value, and policy distinctions just made, we can now make connections:

- impact characteristics, which are fact premises;
- characteristics of impact settings (i.e., impact context), which are fact premises; and,
- people's perspectives on the importance of impacts, which are value premises.

Not only can the tools of argument be used to communicate strong impact significance arguments, they can also be used to guide the impact assessment process leading up to impact significance determinations. The types of premises that are required for well-substantiated impact significance arguments should guide the types of information that are sought throughout the impact assessment process. This would allow for thoroughly supported and justified significance arguments to be formulated at the culmination of the impact assessment process.

Argument analysis methods can also be drawn upon to identify opportunities to formulate stronger arguments (Gasper & George, 1998), as is done in this study. A discussion of argument analysis methods follows.

Argument analysis

Argument analysis is a means of identifying an argument's structure and assessing argument strength. Gasper and George (1998) suggest that the purpose of argument analysis is to gain a better understanding of an argument and to identify opportunities to increase argument

strength. If, as the previous information suggests, arguments are central to determining significance, and if arguments can be stronger or weaker, it is relevant to inquire about the strength of impact significance arguments in practice. Such an inquiry would help identify opportunities to better justify significance conclusions using strong arguments. As noted previously, this is the purpose of this study. The basic tools to analyze and understand argument strength are described here.

The Toulmin Model is a widely used method for argument analysis (Brown, 2011). It provides a method for identifying the components of an argument (e.g., conclusions, grounds, warrants, backing, qualifiers), summarizing them, and representing them in diagrammatic format (Toulmin, 1958). Several authors, including Inch and Warnick (2009), Rieke et al. (2005), Zarefsky (2005), Gasper and George (1998), and Brown (2011) make reference to the Toulmin Model as a means of identifying the components of arguments in an organized way. Gasper and George (1998) note that the Toulmin Model is focused on identifying the structure of short and simple arguments. In contrast, a method proposed by Scriven (1976) is focused on how to evaluate more complex and longer arguments. Scriven's (1976) method consists of seven steps focused on clarifying meanings, portraying argument structure, formulating missing premises, considering relevant alternative arguments, and critiquing the premises to support an overall evaluation of argument strength. In contrast to the general methods proposed by Toulmin (1958) and Scriven (1976), Gasper and George (1998) advocate for devising flexible and content-specific approaches for argument analysis.

Gasper and George (1998) recommend tailoring established methods, such as those specifically of Toulmin (1958) and Scriven (1976), to suit the structure and complexities of the particular argument being analyzed. In particular, they recommend creating numerous linked

Toulmin diagrams to represent subcases in complex arguments, using a coding procedure for labeling argument components, and, in some cases, using tables rather than diagrams to summarize argument elements and portray argument structure.

Whatever the method used, argument analysis is a well-established and recognized means of identifying and evaluating the often unorganized and intertwined components of an argument. As previously noted, an impact assessment is a complex argument consisting of extensive volumes of information in support of impact significance arguments and resulting recommendations for or against project approval. Argument analysis would be an invaluable tool for assessing arguments in the context of impact assessment. Argument analysis could also be used as a means of building stronger arguments, by identifying the types of premises required to support certain types of arguments and subsequently guiding the types of information that are gathered in the impact assessment process. For example, argument analysis could be used to separate out the often interwoven and sometimes unstated fact, value, and policy cases put forth in an impact assessment to ensure that each of these types of cases are sufficiently and acceptably supported by relevant fact, value, and policy premises. This study uses argument analysis methods to assess impact significance arguments, using argument analysis methods derived from Gasper and George (1998), Govier (2005), Scriven (1976), and Toulmin (1958).

Agency Document Review

Statutory and policy documents were reviewed to identify legislated requirements and policies that guide impact significance determinations carried out by the EAO. The *Environmental Assessment Act* (2002) and all five of the regulations established under the *Environmental Assessment Act* (2002) were reviewed to identify the statutory basis for impact significance determinations in British Columbia's impact assessment system.

The *Environmental Assessment Act* (2002) and the *Reviewable Projects Regulation* (2002) set the legislated framework for significance determinations. Under sections 6 and 10 of the *Environmental Assessment Act* (2002) and sections 3, 4, and 10 of the *Reviewable Projects Regulation* (2002) statutory decision makers – either the Minister of Environment or EAO staff, depending on the section – are required to determine whether to designate a proposed project as reviewable (i.e., subject to impact assessment), based on the potential for "a significant adverse environmental, economic, social, heritage or health effect" to result from the proposed project. Because these determinations occur during the screening stage of the impact assessment process, before an impact assessment has been carried out, statutory decision makers are required to make impact significance determinations based on information available about the proposed project before impact assessment studies, including detailed impact predictions, have been conducted. This is typical of impact assessment practice around the world (Wood & Becker, 2005).

The screening stage of impact assessment, when statutory decision makers decide whether to designate proposed projects as reviewable under the *Environmental Assessment Act* (2002), is the only stage of the process during which the *Environmental Assessment Act* (2002) requires the EAO to consider impact significance. Unlike statutes in other jurisdictions, such as Nova Scotia and under Canada federal impact assessment system, the *Environmental Assessment Act* (2002) does not require impact significance to be evaluated during the impact assessment process after project reviewability has been determined. However, despite not being required to do so under the *Environmental Assessment Act* (2002), the EAO assesses impact significance at the conclusion of each impact assessment, as is apparently standard practice in other jurisdictions (Lawrence, 2000; Noble, 2010; Sadler, 1996). It makes sense to evaluate impact significance during the concluding stages of impact assessment. Without concluding on impact significance,

the fundamental question of whether significant impacts are likely, which underpins the requirement for impact assessment in the first place, would be left unanswered.

The policy framework for the EAO's impact significance determinations is primarily set in the EAO's Assessment Report policy, which describes the method used for determining the significance of "adverse environmental, economic, social, heritage and health effects" (EAO, 2011, p. 12). The method is described as follows:

> In addressing what may constitute a "significant" adverse effect, the EAO considers the following factors:
>
> - **Magnitude:** This refers to the magnitude or severity of the effect. Low magnitude effects may have no impact, while high magnitude effects may have an impact.
> - **Probability:** The likelihood that an adverse effect will occur.
> - **Geographic Extent:** This refers to the extent of change over the geographic area of the proposed Project. The geographic extent of effects can be local or regional. Local effects may have a lower impact than regional effects.
> - **Duration and Frequency:** This refers to the length of time the effect lasts and how often the effect occurs. The duration of an effect can be short term or long term. The frequency of an effect can be frequent or infrequent. Short term and/or infrequent effects may have a lower impact than long term and/or frequent effects.

- **Reversibility:** This refers to the degree to which the effect is reversible. Effects can be reversible or permanent. Reversible effects may have lower impact than irreversible or permanent effects.
- **Context:** This refers to the ability of the environment to accept change. For example, the effects of a project may have an impact if they occur in areas that are ecologically sensitive, with little resilience to imposed stresses. (EAO, 2011, pp. 12-13)

This description is accompanied by a footnote explaining that these considerations are "generally consistent with the analysis used in federal environmental assessments under the *Canadian Environmental Assessment Act*, although the EAO has added the factor of 'probability'" (EAO, 2011, p. 12). A review of Canadian Environmental Assessment Agency policies confirmed that these factors are the same as those identified in the Canadian Environmental Assessment Agency's guide to carrying out impact significance determinations (FEARO, 1994) and that the EAO's definitions for the terms are based on the Canadian Environmental Assessment Agency's definitions. In the following sections of this paper, the factors noted above are referred to as *significance factors*.

Two other documents, the *Fairness and Service Code* (2009) and the *Environmental Assessment Office User Guide* (2009), set out policies that are relevant to impact significance determinations. The *Fairness and Service Code* (2009) describes the stages in the impact assessment process, and sets out "Guiding Principles" and "Service Standards" for the British Columbia impact assessment process (EAO, 2009b, p. 1). As noted in the literature review section of this paper, guiding principles for impact assessment in British Columbia are "fairness", "transparency", "inclusiveness", "comprehensiveness" and "efficiency" (EAO,

2009b, p. 9). These principles are consistent with guiding principles recommended in the impact assessment literature discussed previously.

The principles of fairness, transparency, inclusiveness, and comprehensiveness are particularly relevant to impact significance determinations. An explanation of the "fairness" principle in the *Fairness and Service Code* (2009) indicates that the "EAO will undertake objective environmental assessments and will give full and fair consideration to all interests" (p. 9). This suggests that varying points of view (i.e., interests) pertaining to the significance of impacts can be taken into account, which is one of the three main types of premises for impact significance conclusions noted in the impact assessment literature. Under the "transparency" principle, the *Fairness and Service Code* (2009) indicates, "reasons will be provided for all decisions and recommendations made to the Ministers" (p. 9). This guideline suggests that well-substantiated arguments should be presented to support impact assessment conclusions, including impact significance determinations, which lead to decisions during the assessment process and recommendations to ministers. The *Fairness and Service Code*'s (2009) explanation of the "inclusiveness" principle, indicates the "EAO will provide opportunities for all interested parties to participate in the environmental assessment process" (p. 9). Such opportunities for input could be a means of acquiring information about various perspectives on the significance of impacts. Under the "comprehensiveness" principle, the *Fairness and Service Code* (2009) indicates the "EAO…considers the proposed project's potential significant adverse environmental, economic, social, heritage and health effects" (p. 9). However, it is not clear in the document how the environmental, economic, social, heritage, and health aspects of an effect's proposed receiving environment are considered when determining the significance of a given effect.

The "Service Standards" section of the *Fairness and Service Code* (2009) indicates that "proponents, First Nations and the public" (p. 10-14) are participants in impact assessments. Consequently, it would be reasonable to assume that, in addition to provincial cabinet ministers and the various government agencies involved in impact assessments, these three groups are the main audiences for Assessment Reports, and the impact significance arguments they convey.

The *Fairness and Service Code* (2009) also notes that findings of significant adverse effects are not common because impact mitigation measures that would be prescribed upon project approval to avoid significant impacts are taken into account in the significance analysis process.

The *Environmental Assessment Office 2009 User Guide* (2009) is the second major document I reviewed. It describes the legislated framework for impact assessment in British Columbia and gives a detailed overview of the impact assessment process. It indicates that potentially significant adverse effects and the significance of anticipated residual effects are assessed during the process, but does not describe how significance is evaluated (EAO, 2009a). The document also reiterates the principles and service standards presented in the *Fairness and Service Code* (2009). Building on the principle of inclusiveness in the *Fairness and Service Code,* the document indicates that for each assessment, the "EAO's assessment report documents all interested parties views" (EAO, 2009a, p. 8). Based on this principle, it would be reasonable for Assessment Reports to document the views of various parties on the significance of impacts.

Despite the importance of the concept of significance in the EAO's legislated framework and policies, no definition is provided for the term *significant* in any of the EAO's legislation or policy documents. The literature suggests this situation is typical of impact assessment regimes around the world (Canter & Canty, 1993; Gilpin, 1995; Sippe, 1999), and this is certainly typical

of impact assessment regimes in Canada. None of the legislated frameworks for impact assessment systems in any of the Canadian provinces and territories define the term. For example, despite the central role the term *significant* plays in numerous parts of the *Canadian Environmental Assessment Act* (1992), the statute does not stipulate a definition for the term.

Argument Analysis

The purpose of the argument analysis was to assess the strength of impact significance arguments presented by the EAO in its Assessment Reports. It is important to note that during the analysis I did not evaluate whether I agree with impact significance conclusions presented in the sampled cases. Rather, the analysis was focused on assessing how well impact significance cases are supported through the presentation of strong arguments.

A summary of the argument analysis findings is presented here, followed by a detailed presentation and discussion of the findings for each aspect of the analysis. I conclude from the argument analysis that the sampled impact significance cases are relatively weak arguments, for three main reasons. First, I consider the sampled cases to be incomplete arguments because premises are completely or partially absent for all cases. Second, the intended meanings of key terms that play central roles in the sampled arguments are typically not clearly defined. Third, the value based premises supporting significance conclusions are not presented. These issues yield arguments that are not clearly or comprehensively justified. Consequently, I consider that it would be reasonable for a technically informed, critical, and fair-minded reader to choose not to accept the impact significance conclusions for the sampled arguments.

This is not to say that the sampled impact significance conclusions are unfounded. To the contrary, I found that comprehensive information that could have been presented as premises for

impact significance factor subcases (e.g., impact magnitude) is presented outside of the impact significance cases, either elsewhere in the Assessment Report or in the proponents' assessment documents. The issue is that premises are not consistently or comprehensively presented to form coherent, clear, and well-justified arguments that demonstrate why an audience should accept the significance conclusions.

These observations are supported by the findings of the argument analysis, which are presented and discussed below. Recommendations on how to act on the opportunities for improvement identified below are presented later, in Chapter 6.

Argument structure

I found that in the six most recent reports that were evaluated, EAO's significance cases have a complex argument structure consisting of subcases for each of the EAO's significance factors that collectively lead to a conclusion on impact significance (Figure 6). Argument structure varies in the reports prior to the most recent six reports. Some significance cases in earlier reports also use this argument structure, while others present significance conclusions without supporting subcases.

All of the sampled significance cases are generally brief (i.e., less than one page in length) and well-organized, making it easy for the reader to identify the overall impact significance conclusions and, if present, supporting subcases for each of the EAO's significance factors.

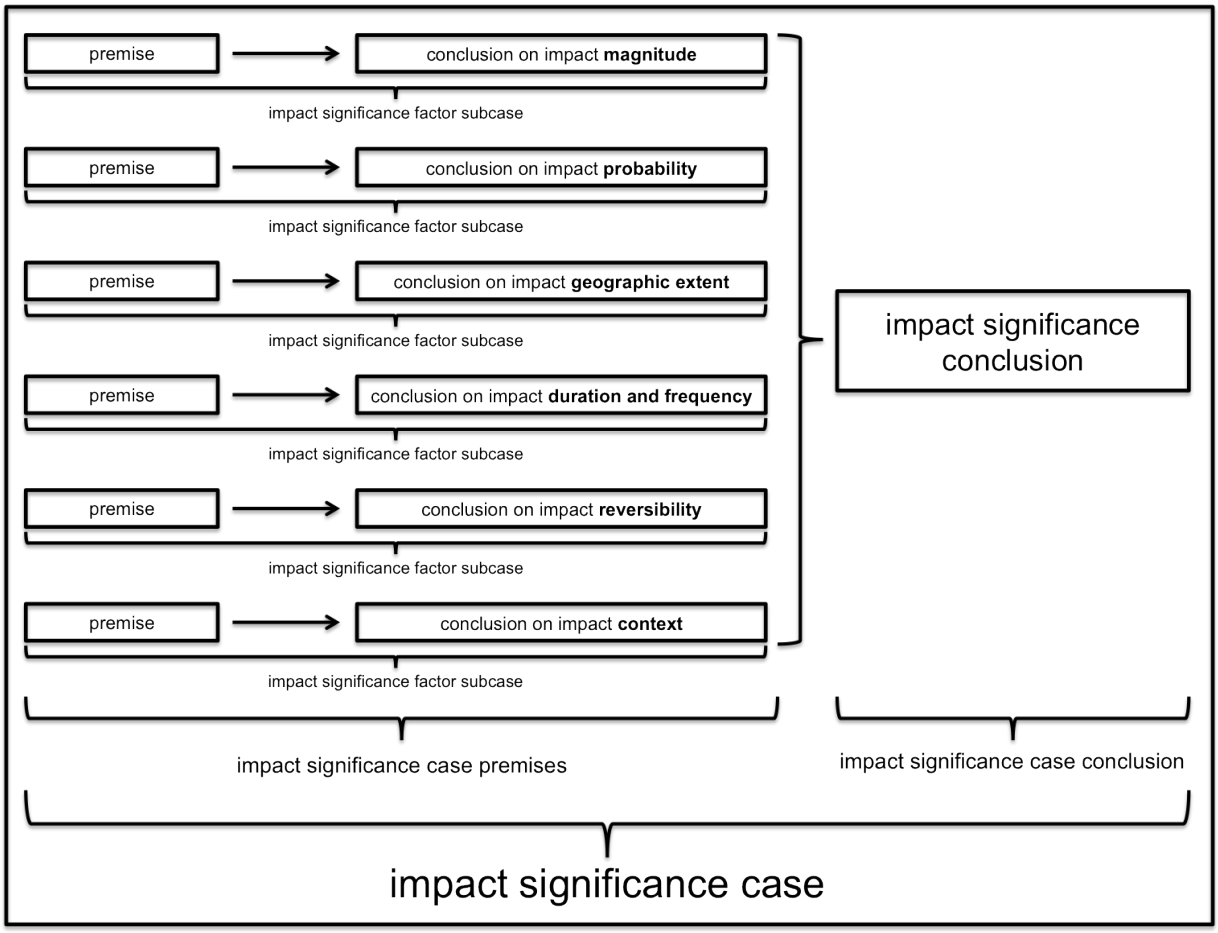

Figure 6. Typical structure of the EAO's impact significance arguments, showing subcases for each of the EAO's six impact significance factors.

Significance analysis method

Description of significance determination method

The method used to assess impact significance is described in every Assessment Report I reviewed. With the exception of a few inconsequential variations in how definitions for some of the significance factors are worded, the method described in every report is the same as that described in the document review section of this paper.

In summary, the method indicates that the EAO considers factors of impact magnitude, probability, geographic extent, duration, frequency, reversibility, and context to arrive at

significance conclusions. However, the method does not describe *how* these factors are considered. For example, there is no description of how the various types of impact characteristics are weighed in significance determinations. Nor does the method specify how contextual factors (i.e., characteristics of the proposed project setting) are considered and weighted. In the absence of such information, it is likely not clear to the reader how impact significance is determined.

Justification of significance determination method

Rationale is not provided in the Assessment Reports to explain why the method for determining significance is considered valid or justified. Only a brief footnote is provided, that indicates the method the EAO uses is basically the same one used by the Canadian Environmental Assessment Agency. An explanation of why the EAO deems its method for determining impact significance to be valid would help the reader better understand why the EAO's impact significance conclusions are justified.

Meanings of key terms

As was previously discussed, a critical aspect of clearly communicating an argument is to clearly convey the intended meanings of key terms. Definitions "make vague terms more precise" (Zarefsky, 2005, p. 33) so that an audience can understand how key terms are being used (Little et al., 1989), thereby eliminating, or at least narrowing, the gap between an audience's interpretations and the meanings an arguer seeks to convey (Rieke et al., 2005). To evaluate the extent to which the meanings of the sampled arguments are clearly expressed, I evaluated the extent to which the intended meanings of key terms (Table 1 on page 38) are clarified.

Key term: Significant

Results

The use of the term *significant* was reviewed in all of the Assessment Reports and in the EAO's legislation and policy documents. The term *significant* is not defined in any of the sampled significance cases. Nor is it defined in the EAO's legislation or policy documents. The EAO's policy documents and the sampled Assessment Reports stipulate factors the EAO considers in making significance determinations, however, these factors do not clarify the intended meaning of the term *significant*.

Discussion

The meaning of the term *significant* is obviously a fundamentally important term in a significance case. It is also a vague and ambiguous term that can be understood in various ways. In the absence of a definition, there are several meanings for the term that a reader could interpret, including meanings for the term in everyday conversation, statistical connotations, and any of the variety of meanings identified in the impact assessment literature. Demonstrating the ambiguity of the term, the *Canadian Oxford Dictionary* (Oxford University Press, 2004) provides four definitions for the word *significant*, as follows: (1) "of great importance or consequence"; (2) "having or conveying an unstated meaning"; (3) "noteworthy, noticeable"; and, (4) "*statistics* of or relating to the significance in the difference between an observed and calculated result" (p. 1446). In addition to these definitions, various definitions presented in the impact significance literature add to the number of ways the term can be interpreted in the context of impact assessment. A few definitions from the impact assessment literature are noted above, in the literature review section of this paper.

In the absence of a definition, not only is the precise intended meaning of the term unclear, but also the scope of significance determinations is unclear. That is, it is not clear whether significance determinations consider only environmental significance, social significance, or economic significance, or a combination of these types of significance. Without clarity around the intended meaning of the term *significant*, the meaning of impact significance determinations remains unclear, certainly for the audience of significance determinations, and perhaps even for assessors.

The EAO is not alone in facing this challenge. A lack of clarity around the meaning of the term *significant* is one of the major challenges noted in the impact assessment literature (Duinker & Beanlands, 1986; Kruger, 2009; Lawrence, 2000; Ross et al., 2006). Despite the widespread use of significance as a cornerstone of impact assessment statutes around the world, most jurisdictions lack a legal definition for the term (Canter & Canty, 1993; Gilpin, 1995; Sippe, 1999), including at the federal, provincial and territorial levels of impact assessment in Canada. The vagueness and ambiguity of the term, combined with the fact that it is commonly used in many different ways in impact assessment (Ross et al., 2006), can results in confusion of meanings and a lack of clarity around which of several potential meanings is intended. For example, the term is used in impact assessment to refer to acceptability (Sippe, 1999), importance (Lawrence, 1997), ecological significance (Ross et al., 2006), statistical significance (Ross et al., 2006) and social significance (Morgan, 1998). Without stipulating an intended meaning for the term *significant* it is not entirely clear what is being argued in a significance case. With many possible definitions for this term that plays a pivotal role in many aspects of impact assessment, including recommendations on project approval or rejection, it would be

beneficial to clarify its intended meaning so that audiences, participants, and administrators of impact assessments share a common understanding of the term.

Key terms: Significance factors

Results

As previously noted, the EAO's significance determination method indicates the EAO considers a standard set of factors pertaining to impact characteristics and impact context to evaluate impact significance. These factors are impact *magnitude*, *probability*, *duration*, *frequency*, *reversibility*, and *context* (EAO, 2011, pp. 12-13). All of these significance factor terms are defined at the beginning of each Assessment Report, using the definitions presented above on page 59. However, I found that the definitions provided for all but two of these terms (*probability* and *context*) do not adequately dispel potential vagueness or ambiguities around how the terms could be interpreted by a technically informed, critical, and fair-minded reader.

Discussion

The EAO's terms for significance factors play pivotal roles in communicating significance arguments because they each represent a subcase of the EAO's significance arguments. It is important that the intended meanings of these terms are clear, so that the intended meanings of the subcases, which function as premises for overall significance conclusions, are also clear.

I found that the terms *probability* and *context* are the only significance factors terms that are defined adequately to dispel potential vagueness and ambiguity. Impact *probability* is defined as, "the likelihood that an adverse effect will occur" (EAO, 2011, p. 12). Impact *context* is defined as "the ability of the environment to accept change" (EAO, 2011, p. 13). Definitions

provided for all of the other terms for significance factors are problematic in a few ways, which are discussed below.

The definitions for *geographic extent*, *duration*, *frequency,* and *reversibility* are problematic in three different ways. First, definitions provided for these terms contain circular reasoning. That is, they use the term being defined to define the term, thereby rendering the definition ineffective. For example the definition for *reversible* states, "this refers to the degree to which the effect is reversible" (EAO, 2011, p. 17). Despite the fact that the term reversible is not particularly vague or ambiguous, there remains some ambiguity to how this the term could be interpreted in the context of impact assessment. For example, it is not clear whether reversibility means the cause of an effect would cease, or whether the effects would actually be reversed, undoing changes that had occurred as a result of the effect. In addition, contrary to a conclusion about the reversibility of effects in one of the cases sampled, some effects are not reversible, such as lethal effects to flora and fauna. However, the causes of lethal effects may be reversible. Ambiguities such as this are not clarified in the definition provided for the term *reversible*. Similar subtle and not so subtle vagueness and ambiguity exists in definitions for the other significance factors that could be addressed through the provision of precise definitions.

The second issue is that the definitions for these four terms (*geographic extent*, *duration*, *frequency,* and *reversibility*) use the terms *effect* and *impact* in two apparently different ways without clarifying whether different meanings are intended and if so what the intended meanings are. For example, the definition for *duration and frequency* states, "short term and/or infrequent effects may have a lower impact than long term and/or frequent effects" (EAO, 2011, pp. 16-17). In everyday conversation and in much of the impact assessment literature, the terms effect and impact are often used interchangeably, as they also are in this document. The *Canadian Oxford*

Dictionary (Oxford University Press, 2004), defines the word *impact* as, "an effect or influence, [especially] when strong" (p.760), suggesting the two words refer to the same concept, but that an impact is an effect of greater magnitude. Given the similarities between the meanings of these terms in everyday language, a definition would be helpful to clarify intended meanings and whether different meanings are intended.

The third issue is related to the second issue. The definitions provided for each of these four terms (*geographic extent*, *duration*, *frequency,* and *reversibility*) suggest that each of these factors have a bearing on impact magnitude, which is an apparently illogical assertion. For example, the definition for *geographic extent* states that, "local effects may have a lower impact than regional effects" (EAO, 2011, p.16). The term *lower* in this definition seems to allude to impact magnitude, an impact significance factor that seems to be unrelated to geographic extent. For example, the magnitude of a water quality effect could be described as the concentration of a contaminant in a water sample. The geographic extent of such an effect is an unrelated characteristic that would be described as the area covered by water containing a given concentration (i.e., magnitude) of a contaminant.

The definition for *magnitude* is also problematic in a couple ways. Magnitude is defined as, "this refers to the magnitude or severity of the effect. Low magnitude effects may have no impact, while high magnitude effects may have an impact" (EAO, 2011, p.16). This definition contains circular reasoning, by using the term being defined in the definition. An additional limitation of this definition is that, if the terms *effect* and *impact* are understood to have the same meaning, the second part of this definition is self-contradictory and meaningless. The statement, "low magnitude effects may have no impact" (EAO, 2011, p.16), implies the terms *effect* and

impact are intended to have different meanings, but, as previously noted, the meanings of these terms are not defined.

Considering that the meanings of these terms are critical to explaining and justifying significance conclusions, it would be beneficial to stipulate clear definitions that avoid potential vagueness and ambiguity. I acknowledge that by stipulating definitions for these terms, the EAO has taken a worthwhile step toward clarifying intended meanings. However, they could be further refined. Clarifying the intended meanings of these terms would serve to clarify the intended meanings of significance arguments.

Key terms: Descriptive terms

Results

I reviewed the use of 20 key descriptive terms that are potentially vague and/or ambiguous to determine if the intended meanings of these terms are clarified adequately enough to support the reader in clearly interpreting their intended meanings. Examples of these terms include, *high*, *low*, *disturbed*, *regional,* and *infrequent.* A complete list of the descriptive terms that I reviewed is provided in Table 1 on page 38.

One or more of these descriptive terms are used to describe impact significance, impact characteristics, or impact context in 113 instances within 24 of the 33 cases that were sampled. Of these 113 instances, intended meanings of terms are clarified in 15 instances to the extent that I believe a technically informed, critical, and fair-minded reader would be clear on the intended meanings.

In the other 98 of these 113 instances, no definitions or clarifying statements are provided to clarify intended meanings.

In the 14 instances that clarify meanings, three different approaches are used to clarify meanings: definitions, clarifying statements, and adjectives. In eight instances, terms are clarified by stipulating a definition. For example, in one of four cases that use the term *regional* to describe the geopgraphic extent of an impact, a definition is provided that identifies the geographic area represented by the term. In three instances, terms are followed by a clarifying statement. For example, in three out of seven cases that use the term *disturbed* to describe impact context, the term is accompanied by a reference to industrial development to describe the general type of disturbance being referred to. In three instances, terms are somewhat clarified through the use of an adjective. For example, in two out of seven cases that use the term *disturbed* to describe impact context, the term is somewhat clarified by modifying it with the adjective *industrial*.

Discussion

In the absence of clearly stipulated definitions, descriptive terms constrain the clarity of the cases in which they are used. The signficance factor subcases that convey clearer meanings are those that present a emprical descriptions of impact characteristics, instead of using descriptive terms, and those that clarify the meanings of descriptive terms.

All of the descriptive terms that I reviewed are potentially vague, because it is not clear exactly what they are intended to mean in the absence of clarifying explanations. Some of the terms, such as *project footprint* and *reversible,* are also ambiguous, because they can be interpreted in more than one way. For example, in the six cases that use the term *project footprint* to describe the geographic extent of an effect it is not clear whether the term refers to the geographic area occupied by project components, or the geographic area affected by project effects, as could be interpreted by readers who are familiar with the "ecological footprint"

concept. It is important that the intended meanings of descriptive terms are clear because they are used to describe the premises for impact significance cases. For example, the term *low* is used to express impact magnitude conclusions in several subcases, by indicating impact magnitude is low. Without a clear indication of what *low* means, these subcases do not offer particularly clear or strong backing for the significance conclusions they are intended to support.

All of the sampled terms are used to describe impact characteristics or impact context in comparative ways. For example, *project footprint* impacts are contrasted with *regional* impacts. A *disturbed* ecological context is contrasted with an *undisturbed* ecological context. *Low* magnitude impacts are contrasted with *high* magnitude impacts. In the absence of definitions or other clarifying explanations, all of these terms are too vague and/or ambiguous to clearly express the intended meanings of the terms and the conclusions they represent, even within the contexts of the subcases in which they are used.

All of these descriptive terms would be more useful for clearly communicating conclusions if they were defined and if thresholds that are used to differentiate between comparisons were explicit. Alternatively, and perhaps more effectively, these terms could be avoided in many or all cases by describing impact characteristics and context in empirical terms. For example, instead of describing magnitude as *low*, an emperical measurement could be provided, such as parts per million of a contaminant, tonnes of greenhouse gases, hectares of habitat loss, population mortality rates, or decibels of noise disturbance. Regardless of the method used, to present strong arguments in support of impact significance conclusions, the intended meanings of key terms should be clear.

Impact significance conclusions

Results

Significance conclusions are presented for all 33 of the cases sampled. Each of the conclusions consists of a succinct statement that indicates whether the EAO deems predicted residual impacts (i.e., impacts remaining after mitigation measures) to be significant or not.

Discussion

Even though conclusions about the significance of predicted impacts are presented in every case, the intended meanings of the conclusions are not entirely clear because, as previously discussed, the term *significant* is not defined. The meanings of significance factor subcase conclusions are similarly constrained, because, as previously discussed, the definitions provided for significance factors do not entirely alleviate vagueness and ambiguity associated with all but two of the terms. However, the meanings of subcase conclusions are clearer than conclusions about the significance of each impact because there is less vagueness and ambiguity associated with the meanings of impact significance factors than with the meaning of the term *significant*. Stipulating a precise definition for the term *significant* and indicating what type of significance (i.e., environmental, social, economic, health, or heritage significance, or some combination thereof) is being concluded on in each case would greatly improve the clarity of significance conclusions.

Premises

Premise presence: Results

I reviewed all of the significance cases and subcases in the sample to determine if premises are presented. I found that premises are explicitly presented for 24 of the 33 cases in the sample (Figure 7). Of these 24 cases, 20 cases present conclusions on each of EAO's impact

significance factors (Figure 7). The other four cases in these 24 provide premises pertaining to impact characteristics or impact mitigation measures, but they are inconsistent with the EAO's stated impact significance analysis method because they do not address the EAO's set of impact significance factors.

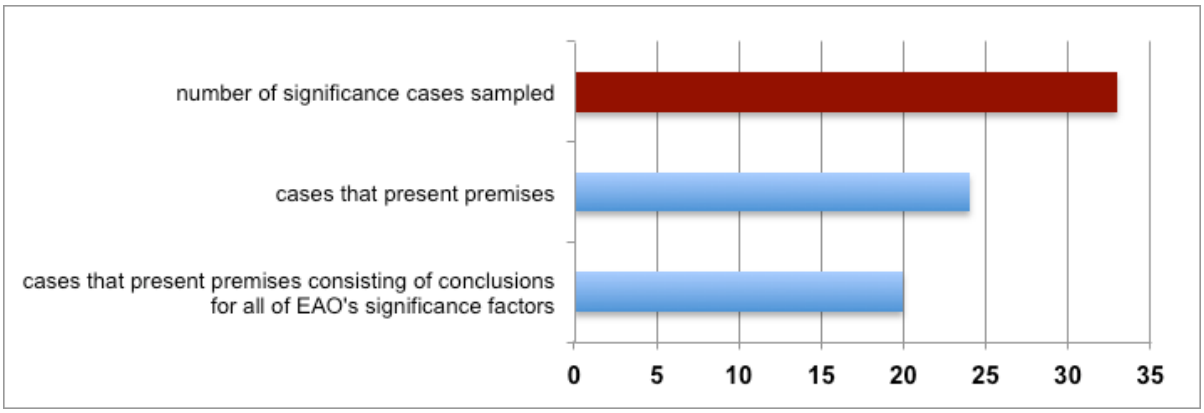

Figure 7. Summary of findings related to the presence and composition of premises for impact significance conclusions.

Nine of the 33 cases do not present conclusions on the EAO's significance factors or provide any other type of specific premises. Rather, these nine cases make general references to volumes of information, such as the proponent's assessment, and/or an analysis immediately preceding the significance conclusion. But no references are provided to tell the reader where specific premises can be found in the cited volumes of supporting information. Nor is an analysis or significance evaluation apparent in the text preceding these conclusions. Rather, the preceding information consists of a record of issues raised by review participants and the proponent's responses. No analysis is provided indicating how this information relates to or supports the ensuing conclusions on impact significance. Because no explicit and specific premises are presented in these nine cases, I decided these general references to supporting information could not be accepted as premises in the argument analysis.

As noted above, I found that 20 cases present conclusions on each of EAO's impact significance factors. However, none of these 20 cases present explicit premises for all of their significance factor conclusions. I found that premises are not presented for an average of four out of six significance factor conclusions in these cases.

If all of the 33 impact significance cases that I sampled presented conclusions for all of the EAO's significance factors, there would be 198 impact significance factor conclusions in the sample (Figure 7). However, as noted above, only 20 of the 33 cases present significance factor conclusions for all of the EAO's significance factors. These 20 cases present a total of 120 conclusions on significance factors (Figure 8). I determined that 117 of the conclusions presented in relation to EAO's impact significance factors require the support of premises to explain the reasons supporting conclusions (Figure 8). My rationale for this determination follows.

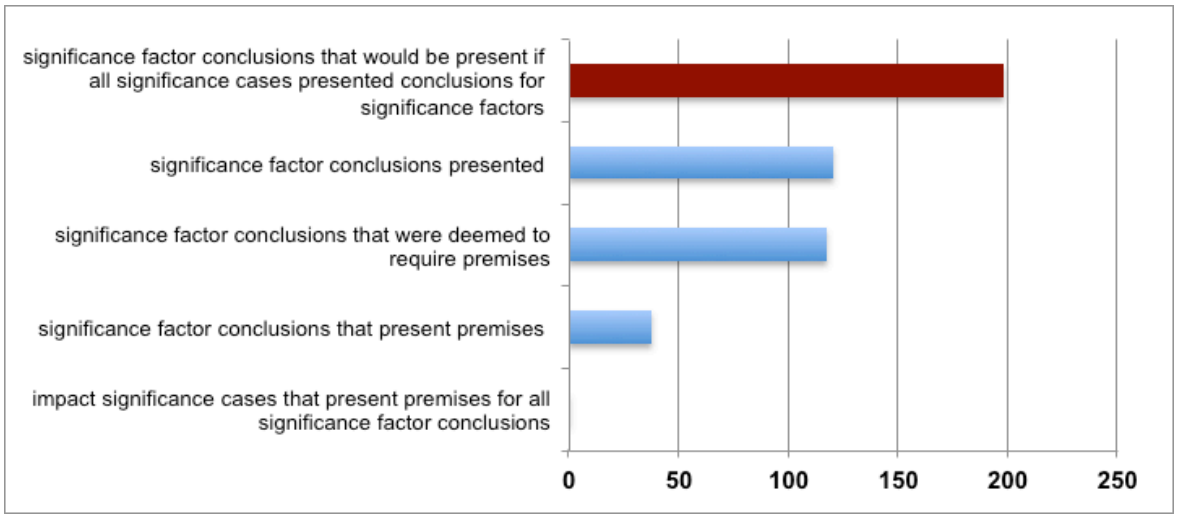

Figure 8. Summary of findings related to presence and absence of premises for impact significance factors (e.g., impact magnitude, duration, reversibility).

Of the 120 significance factor conclusions, 100 are conclusions about predicted impact characteristics. I determined that all but one of these conclusions require the support of premises

because they contain several sources of uncertainty, as Wood (2008) explains is typical of impact predictions. The one conclusion that I determined does not require explicit premises is a conclusion about climate change effects that are predicted to result from carbon emissions. I believe most readers would be aware of the premises for this conclusion in the absence of explicit premises. I therefore decided this conclusion is supported without explicit premises.

The 20 significance factor conclusions that do not address impact characteristics are conclusions about the EAO's impact context significance factor. These conclusions are brief descriptions about one or two characteristics of the settings where impacts are predicted to occur. I determined that two of the 20 impact context conclusions do not require the support of premises because they are statement that most readers are likely to accept without explicit premises. For example, one of the conclusions was a statement that a wildlife species is designated as at risk under federal legislation. I determined that the other 18 conclusions about impact context require premises because it would be reasonable for a technically informed, critical, and fair-minded reader to not accept the conclusions in the absence of explanations supporting the conclusions. As a result of these considerations, I determined that it would be reasonable for a technically informed, critical, and fair-minded reader to ask for explicit explanations of the reasons and rationale supporting 117 of the impact significance factor conclusions in the sample.

I found that premises are presented for 36 out of these 117 impact significance factor conclusions (Figure 8). These 36 subcases make brief but specific references to reasons or rationale supporting the conclusions they present. The acceptability, relevance, and sufficiency of these premises are discussed later. In the other 81 of these 117 cases, no premises are explicitly presented in support of significance factor conclusions. For example, some of the

subcases pertaining to impact magnitude conclude that the predicted impact magnitude is "low" and do not present reasons to support such a conclusion.

Premise presence: Discussion

As noted above in the argumentation literature review section, premises are a fundamental building block of effective arguments. Premises are the reasons, rationale, and data supporting an argument's conclusions. If an audience to an argument, such as someone reading an impact significance case, does not have adequate knowledge of the premises supporting a conclusion because its premises are not clearly presented or have notable weaknesses, it would reasonable for that audience to not accept the argument's conclusion.

The findings noted above indicate that most of the arguments presented are not complete. They do not present complete sets premises in support of all, or even most, of their conclusions. In addition, over one third of the cases (13 out of 33) do not indicate how the EAO's stated method for significance determination was used to arrive at significance conclusions. Furthermore, nearly one third (9 out of 33) of the cases do not present any explicit premises in support of significance conclusions.

These findings indicate the cases are not packaged as complete and explicit arguments. But, this is not to say that the volumes of impact assessment information leading up to the sampled significance determinations do not contain data that could be presented as explicit support for the impact significance factor conclusions. To the contrary, a closer examination of eight cases found supporting information does exist for all of the subcases. So the problem is not that the data does not exist. The problem is that data that could be presented as explicit premises for significance factor conclusions is not presented.

Not only are premises typically not presented in support of significance factor conclusions, but it is also not easy for the reader to make precise connections between significance factor conclusions and possible supporting information that is available elsewhere in the Assessment Report. Upon closer examination, it becomes apparent in most of the sampled cases, regardless of whether premises are provided for significance factor conclusions or not, that the significance factor conclusions stem from information that is presented in the preceding sections of Assessment Reports. But only rarely are the significance factor terms (e.g., magnitude, duration, reversibility) used in the preceding sections of the reports. This makes it difficult for readers to link potential supporting information in earlier sections of the reports with the ensuing significance factor conclusions and subsequent conclusions on impact significance. For example, a section of one of the Assessment Reports discussed impacts to vegetation that would result from a proposed project and gives a substantial amount of detail about the impact, including why the impact is predicted to occur and the extent of the impact. Then, following that section of the report, a significance analysis is presented that indicates the magnitude of the impact is "low". Yet, the term *magnitude* was not used to describe the impact in the earlier portion of the report. Nor does the significance analysis define what "low" means in explicit terms, or provide premises to explain why the impact is deemed to be comparatively "low". Consequently, there is no clear linkage between the impact significance analysis and the preceding discussion about the characteristics of the impact. Furthermore, information that could be presented as explicit premises to convey thoroughly justified impact significance is not presented as such. This yields arguments that are not explicitly justified, and are therefore incomplete and relatively weak.

Premise acceptability, relevance, and sufficiency

Presenting premises in support of conclusions is an essential step toward building strong arguments. However, the principles of argument point out that to build strong arguments it is also imperative that the premises which are offered as support for conclusions are viewed by an argument's audience as acceptable, relevant, and sufficient. Findings pertaining to the acceptability, relevance, and sufficiency of premises are presented and discussed below.

Premise acceptability: Results

To support my evaluation of the acceptability of impact significance factor premises presented for each impact significance conclusion, I first evaluated the acceptability of each of the premises provided for impact significance factor conclusions. As previously noted, premises are provided for 36 out of the 117 significance factor conclusions that were deemed to require premises. I found that it would be reasonable for a technically informed, critical, and fair-minded reader to view all 36 of these premises as believable and plausible, and therefore acceptable. My rationale for this finding is that these 36 premises are either common knowledge, convincing arguments from authority, or are plausible arguments of cause and effect.

As previously noted, I found that 20 out of the 33 sampled impact significance cases present explicit premises for the EAO's impact significance factors. I determined that it would be reasonable for a technically informed, critical, and fair-minded reader to view at least one premise provided in 16 of these 20 cases as believable and plausible, and therefore acceptable. My rationale for this finding is that one or more impact significance factor conclusions in each of these 16 cases is supported by what is likely to be viewed by a technically informed, critical, and fair-minded reader as a cogent argument, common knowledge, a convincing argument from authority, or a plausible argument of cause and effect. For example, one of the conclusions

about impact duration concludes that impacts to fish resulting from culverts in a stream would endure for a long period of time based on the premise that the culverts would remain in place for a long period of time. Even though these premises are very brief and there is some vagueness associated with the expression "long period of time", I found that these premises are acceptable, relevant, and sufficient enough to support the associated conclusion on impact duration. Consequently, I deemed the conclusion on impact duration to be an acceptable premise for the ensuing conclusion on impact significance. This is not to say, however, that this premise alone offers sufficient or clearly relevant support for the ensuing impact significance conclusion. The relevance and sufficiency of premises are separate issues that are discussed later.

Premise acceptability: Discussion

I found premises to be acceptable for all of the impact significance factor arguments that provide premises. However, the acceptability of premises could have been better established in many instances by providing more thoroughly developed lines of reasoning. The argumentation literature can be drawn upon to explore how to better develop acceptable premises, by employing distinct types of lines of reasoning that are appropriate for an argument's intended audiences.

Premise relevance: Results

I found that it would be reasonable for a technically informed, critical, and fair-minded reader to view premises as not clearly relevant to their associated conclusions on impact significance for all 20 of the 33 cases that present premises for the EAO's impact significance factors. My rationale for this finding is that no reasons (i.e., warrants) are provided to explain how the premises in each case are relevant to impact significance and why they support the impact significance conclusions.

With respect to conclusions presented for the EAO's impact significance factors, I found that premises for 34 of the 36 impact significance factor conclusions that present premises are clearly relevant to the conclusions presented. For example, in two cases, conclusions about impact duration are partially supported by premises that indicate how long the proposed project is expected to be in operation. These premises are clearly relevant to conclusions about impact duration because in these cases the project would clearly be the cause of the impact.

I found that it would be reasonable for a technically informed, critical, and fair-minded reader to view two of the 36 premises presented for significance factor conclusions as not relevant to their associated conclusions. For example, in one of these instances a conclusion pertains to impact magnitude but the premises address impact probability, not magnitude. In the other instance, a conclusion about the reversibility of climate change effects resulting from carbon emissions is based on the premise that carbon emissions cannot be withdrawn once they occur. It would be reasonable to suggest this premise is not necessarily relevant to determining whether climate change effects are reversible. Even if it is, no rationale is provided to explain how this premise is relevant to the reversibility of climate change effects.

Premise relevance: Discussion

As noted above, I found that none of the premises presented offer clearly relevant support for their associated conclusions on impact significance. However, there is an important nuance in my rationale supporting this finding. Even though I found that it is not clear how premises are relevant to specific impact significance conclusions, I found that the premises for significance factor conclusions are relevant to the general concept of impact significance. These may seem like contradictory findings, but they are not, as will be explained later.

The EAO's impact significance factor conclusions, and supporting premises, describe impact characteristics and impact context. Both of these types of considerations are recognized in the impact assessment literature and in the EAO's stated significance determination method as premises that are relevant to impact significance. But there is a difference between how these considerations are recognized in the literature and the EAO's method. Several authors in the impact assessment literature explain how impact characteristics and impact context are relevant to impact significance conclusions, such as Noble (2010) and Sippe (1999). In contrast, neither the EAO's stated significance determination method or any of the sampled cases explain how impact characteristics and impact context are relevant to impact significance. In the absence of such explanations (i.e., a warrants), I found that it would be possible for a technically informed, critical, and fair-minded to not understand how or why the EAO's conclusions on impact characteristics and impact context (i.e., the EAO's impact significance factors) offer relevant support for conclusions on the significance of an impact. For example, in a case that indicates the predicted magnitude of an impact is high, the geographic extent is local, impact duration is twenty years, impact frequency is intermittent, and the impact's setting is ecologically disturbed, it is not clear how these premises relate to and support a finding of no significant impact, or a finding of a significant impact. A warrant could be supplied in all of the sampled cases to explain why significance factor conclusions such as these collectively support a given conclusion on impact significance. For example, a warrant could explain how each of the significance factors were considered and weighted to arrive at an overall conclusion on significance. A warrant such as this could bridge the inferential leap between premises and conclusions when it may not be clear to an audience why premises are relevant to a particular conclusion, thereby yielding a stronger, more explicitly supported argument.

Premise sufficiency: Results

I found that it would be reasonable for a technically informed, critical, and fair-minded reader to view premises for all the sampled impact significance cases as insufficient. There are four reasons for this finding. First, according to the impact assessment literature and argumentation literature, conclusions on impact significance are value based conclusions. Consequently, they require value based premises for support. But value based premises are not presented in any of the sampled cases. Second, premises are not presented for most of the relevant contextual factors that the impact assessment literature identifies as being relevant to carrying out sufficiently supported impact significance determinations. Third, as discussed previously, none of the cases in the sample provide explicit premises to support every conclusion, yielding arguments that are not sufficiently supported by explicit premises. Fourth, a detailed analysis of premises for significance factor conclusions found that premises for 21 out of the 36 significance factor conclusions that present premises could be viewed as not sufficient to fully explain why the significance factor conclusions are justified.

Premise sufficiency: Discussion

A major finding resulting from my review of impact assessment literature and argumentation literature is that impact significance cases are "value cases", in the argumentation literature meaning of the term *value*, because they are evaluative judgments. Consequently, they require an appropriate mix of fact and value premises to be sufficiently supported (Brown, 2011; Rieke et al., 2005). The results of the argument analysis show that impact significance cases are sometimes missing the fact premises and in every case are missing the value premises they need, making them very weak arguments.

Fact based premises identify *what* is being judged in a value case. For impact significance cases, fact premises should, according to the impact assessment literature and the EAO's stated significance analysis methodology, consist of descriptions of impact characteristics and impact context. The argument analysis data shows that this information is often either missing (in 12 out of the 33 cases) or that conclusions on these factors are not explicitly supported. Impact characteristics are identified in a comprehensive manner in nearly two-thirds of the cases sampled. However, considerations of impact context are very limited or missing in every case sampled. In the cases that discuss impact context, only a narrow range of one or two contextual factors are discussed, such as ecological disturbance and ecological resilience. Consequently, I found that it would be reasonable for a technically informed, critical, and fair-minded reader to ask for a more comprehensive discussion of impact context in every case.

As was discussed previously in the impact significance literature review, considerations of impact context play an essential role in significance determinations (Baker & Rapaport, 2009; Kjellerup, 1999; Kruger, 2009; Lawrence, 2007a; Morgan, 1998; Morris & Therivel, 2009; Noble, 2010; Rossouw, 2003; Sadler, 1996; Sippe, 1999; Weston, 2000; Wood, 2008; Wood & Becker, 2005). The impact assessment literature indicates that several aspects of an impact's context are relevant to evaluating impact significance, including environmental, social, economic, and regulatory characteristics of an impact's setting.

Descriptions of impact context are fact based premises that provide a framework for understanding the value based premises related to an impact. For example, a conclusion about the social context of an impact to a salmon population could identify that

the salmon population is a major source of food for an aboriginal community. This fact based conclusion would provide a framework for understanding a value based conclusion offered by the community indicating they view impacts to the salmon population as unacceptable, grave, or "significant". Thus, contextual considerations provide an arena in which to understand people's perspectives on the importance or gravity (i.e., significance) of an impact. Identifying the context of an impact in an impact significance case allows a reader to better understand to whom, or what, an impact is deemed to be significant or not. Explicitly assessing impact context is a way to bring to the surface the value premises that are considered implicitly, and sometimes perhaps even unknowingly, in significance judgments.

Although significance cases are value cases, from an argumentation point of view, I found that they are not treated as such in any of the sampled cases. My rationale for this finding is that none of the sampled cases present the value premises upon which significance judgments are based. Apparently, the EAO is not alone in facing this challenge. Lawrence (2007b) indicates value based reasoning is often left unstated in impact assessment documents (Lawrence, 2007b). Several authors have recommended that value based premises be emphasized in significance determinations (Canter & Canty, 1993; Lawrence 2007a, 2007b; Noble, 2010; Morgan, 1998; Rossouw, 2003; Sadler, 1996; Thompson, 1990), including whose values they represent (Roussow, 2003; Thompson, 1990), and how competing values are evaluated (Kruger, 2009). For example, Sadler (1996) advises that impact significance determinations should, "in the final analysis, recognize that the evaluation of significance is subjective, contingent upon values, and dependent upon the environmental and community context" (p. 121). Being explicit about the value based premises supporting impact significance

conclusions would be a means of overcoming what Lawrence (2007b) refers to as "a propensity [for impact assessment documents] to cloak subjective reasoning in 'objective' scientific and technical language" (p. 745).

Chapter 5: Conclusions

The findings of the research lead to two major conclusions in answer to the research questions. The research questions are:

1. To what extent are impact significance determinations justified as strong arguments in provincial impact assessment in British Columbia?
2. What methods can be used to better justify and communicate impact significance determinations as strong arguments?

Conclusions in answer to each of these questions are presented below. Recommendations identifying possible ways act to on opportunities presented by each of these conclusions are presented in the next chapter.

Conclusion 1: Impact significance determinations are not well-justified as strong arguments, and could therefore be better substantiated

In answer to the first research question, the findings of the argument analysis indicate that it would be reasonable for a technically informed, critical, and fair-minded reader to find that the arguments are not strong. As a result, I found that it would be reasonable for readers to ask for more explicit and comprehensive reasons supporting the impact significance conclusions in all of the 33 cases that I sampled. The findings of the argument analysis also indicate that key terms could be better defined to clarify the intended meanings of premises and conclusions. These conclusions are based on the findings presented below in Table 2, summarizing my research

results from examining the major features of arguments. These findings are also represented in Figure 9 on the following page.

Table 2

Summary of Argument Analysis Findings

Argument Analysis Test	**Finding**
1. Is the significance determination method described and is rationale provided to justify the method used?	All of the Assessment Reports describe the method used, but none provide rationale to explain why the method is valid.
2. To what extent are the intended meanings of key terms explicitly clarified to avoid potential problems with vagueness and/or ambiguity?	None of the cases clarify the intended meanings of every key term that is potentially vague or ambiguous.
3. Are premises provided for conclusions?	Only 24 out of 33 cases present premises that identify specific reasons and rationale for their impact significance conclusions.
4. To what extent are significance conclusions supported by premises?	Based on the findings noted above, and the findings pertaining to the acceptability, relevance, and sufficiency of premises (see below), none of the conclusions are explicitly supported by comprehensive premises. In addition, none of the cases present premises for all sub-conclusions (i.e., impact significance factor conclusions).
4.1. To what extent are premises acceptable?	Only 16 out of 33 cases present one or more acceptable premise for impact significance factor conclusions (e.g., conclusions on impact magnitude, duration, or geographic extent).
4.2. To what extent are premises relevant?	None of the cases explain how premises are relevant to, and therefore justify, overall conclusions on impact significance.
4.3. To what extent are premises sufficient?	None of the cases present premises that are sufficient, according to the necessary types of premises that are identified in the impact assessment literature and the argumentation literature.

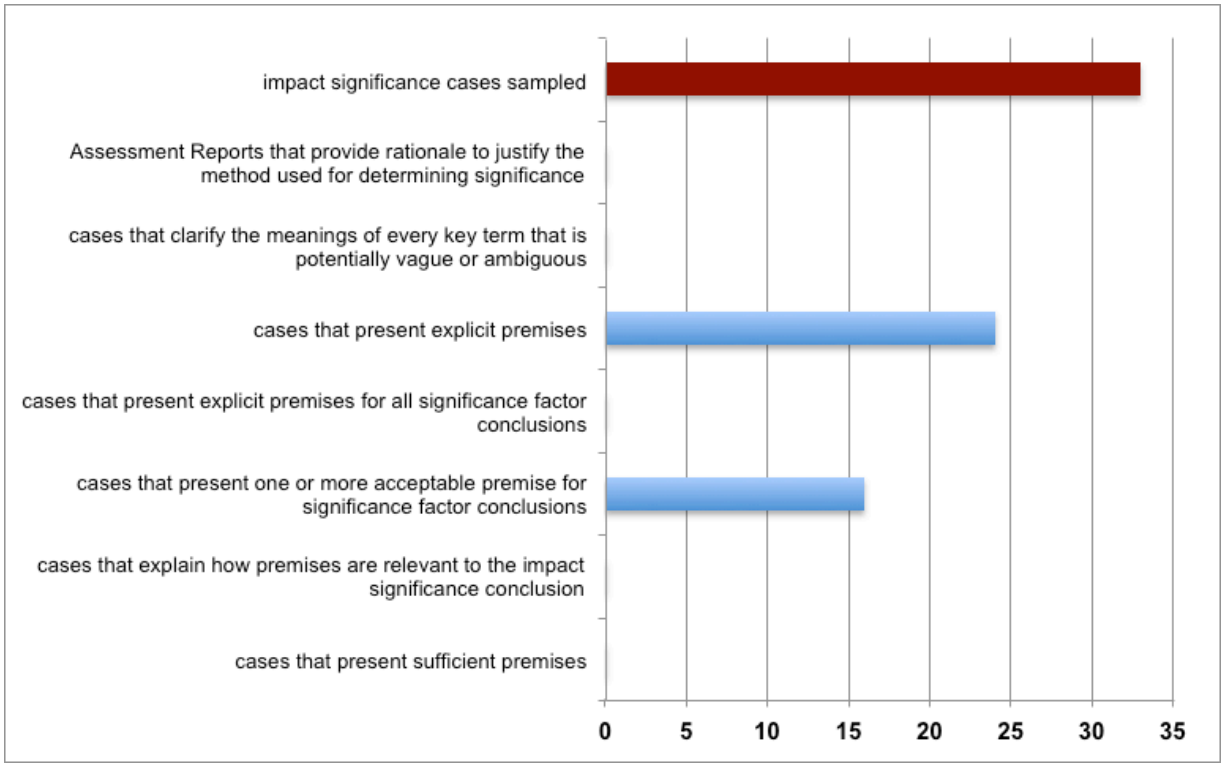

Figure 9. Summary of argument analysis findings.

These findings indicate that in the 11 Assessment Reports I reviewed, the EAO's impact significance cases are not packaged as complete, explicit, and therefore strongly convincing arguments. As previously discussed, the problem is not that the data does not exist in the impact assessment documents associated with the sampled cases. A detailed analysis of eight cases found that supporting information does exist in the associated impact assessment documents for each case that could have been presented as specific and explicit premises. The problem is that data that could be presented as explicit premises for significance factor conclusions is not presented. This yields impact significance arguments that are not clearly and explicitly justified and are therefore weak arguments. Evidently, impact significance arguments could be improved upon.

Conclusion 2: The impact assessment literature and argumentation literature offer several recommendations and tools that could be used to better substantiate impact significance determinations

In answer to the second research question, the study found that impact significance determinations can be better substantiated by following recommendations in the impact assessment literature and the argumentation literature. Recommendations from the impact assessment literature about what constitutes a well-substantiated impact significance determination can be drawn upon to ensure certain types of data are assessed in impact significance determinations. The tools of argumentation can be used to present explicit, comprehensive, and clearly communicated reasons for conclusions on impact significance. Recommendations on specific methods that can be used to better justify and communicate impact significance determinations as strong arguments follow.

Chapter 6: Recommendations

The above results show that the sampled arguments are pervasively weak and that a series of identified mechanisms exist to improve impact significance arguments. The recommendations provided here address how to use the latter observation to improve the former situation.

The principle recommendation of the thesis is to change practices so that impact significance determinations are presented as strong, well-justified arguments that explicitly, coherently, and precisely present the reasons and rationale supporting significance conclusions. The field of argumentation provides an abundance of well-established methods for building strong arguments that can fulfill impact assessment's principle of transparency by making the reasons and rationale supporting significance conclusions apparent. In answer to the second

research question, this chapter recommends several methods that can be drawn upon to better justify and communicate impact significance determinations as strong arguments.

Not only would strong and explicit arguments be clearer and more convincing in an absolute sense, but they would also better fulfill the EAO's guiding principles of transparency, comprehensiveness, fairness, and inclusiveness. The transparency and comprehensiveness of an impact significance case correlates to the clarity and comprehensiveness of premises provided for impact significance conclusions. In the absence of clearly and thoroughly explained reasons and rationale (i.e., premises) for significance conclusions, transparency is constrained. The fairness and inclusiveness of a significance case depends upon the degree to which the varying views of people who provide input to effects assessments are considered in the value based judgments involved in determining significance. Such views can be made explicit by presenting the value based premises for significance judgments and indicating how they relate to the views of various groups of people, such as technical experts and potentially affected parties, on the acceptability, importance, or gravity of a given impact.

The following recommendations have been formulated specifically for the EAO. However, given that the impact assessment literature indicates impact significance determinations tend to be poorly substantiated in other jurisdictions (Kruger, 2009; Lawrence, 2007a; Ross et al., 2006; Rossouw, 2003; Wood, 2008) these recommendations could be beneficial for impact assessment practice in jurisdictions beyond British Columbia.

It is recommended that the recommendations presented below are explored and implemented incrementally. A planned process of incremental change could allow time for impact assessment practitioners and other impact assessment participants to have opportunities to progressively engage with, potentially refine, and implement the recommendations of this study.

This would allow time for impact assessment practitioners to become familiar with and effectively implement each of the recommendations, or portions of the recommendations. Framed within a process of continual improvement, results of implementing the recommendations could be monitored to identify further opportunities to refine approaches to determining impact significance. In addition, the literature on "organizational change" could be explored to identify potential methods for facilitating collaborative and successful improvements to established processes that are part of the fabric of impact assessment agencies, such as the EAO.

Recommendation 1: Better Define key terms

It is recommended that definitions be stipulated to clarify the intended meanings of every important term and that existing definitions be improved upon. Terms should be defined in ways that remove potential vagueness and ambiguity associated with how the terms can be interpreted by both authors and readers. For authors (i.e., impact assessment staff at the EAO), precise definitions would bring more consistency to how the terms are understood, thereby contributing to consistency in how impact significance determinations are carried out and communicated by different authors. For readers, definitions would help to clarify the intended meanings of conclusions and premises in impact significance cases for readers.

Three specific sets of definitions are primary targets for either refining existing definitions or providing new ones, as follows.

Key term: Significant

It is particularly important that the intended meaning of the term *significant* is clarified. The impact assessment literature provides several definitions for the term that could be drawn

upon to clarify its intended meaning. It is also recommended that the intended scope of significance determinations be defined so that it is clear whether significance determinations conclude on environmental, social, economic, or regulatory significance, or various combinations thereof for different types of impacts. If the scopes of significance determinations are intended to be different for different types of impacts, then different definitions may be necessary to distinguish between each corresponding types of significance determination. The use of adjectives can also be helpful for clarifying the intended scope of significance determinations. For example, indicating *environmental* significance or *social* significance serves to clarify what kind of significance is being considered and hence distinguishes between what could become separate definitions for the term *significant*.

Key terms: Impact significance factors

It is recommended that the intended meanings of significance factor terms be further clarified, such as impact *magnitude*, *probability*, *geographic extent*, *duration*, *frequency*, *reversibility* and *context*. Even though, as discussed above, the meanings of these terms may seem evident and the EAO already has definitions for these terms, these terms are all vague and ambiguous to varying degrees. As noted previously, most of the EAO's current definitions do not completely alleviate vagueness and ambiguity. Providing better definitions for these terms that alleviate ambiguity and vagueness, within the context of impact significance determinations, would contribute substantially to the overall clarity of impact significance arguments.

Key terms: Descriptive terms

Descriptive terms that assign a ranking, such as *negligible*, *low*, *moderate*, and *high,* were also noted to be problematic because intended meanings are not clarified. It is recommended that such terms either be avoided, by providing empirical descriptions of impact characteristics

instead of using these terms, or that definitions and thresholds are stipulated to clarify the intended meanings of these types of terms. If thresholds are established to differentiate between terms such as *high*, *moderate*, and *low*, it is recommended that rationale (i.e., premises) for selecting specific thresholds are explicit. Establishing strongly justified thresholds that identify boundaries between ranking terms such as *high*, *moderate*, and *low* for any given type of impact would likely be a highly complex process involving comparative analyses of the local, regional, and provincial contexts of the impacts being assessed.

Recommendation 2: Present comprehensive and clearly organized premises for every conclusion and sub-conclusion

It is recommended that comprehensive and thoroughly justified premises are presented for every conclusion and sub-conclusion in impact significance cases, so that the reasons and rationale supporting significance conclusions are readily apparent. It is reasonable to assume that people may disagree on the attribution of significance to a given impact, because reasonable people can and do disagree, particularly in relation to arguments that involve both fact and value premises, such as significance cases. Presenting premises that comprehensively explain the reasons and rationale supporting an impact significance conclusion can make it clear to an audience how an impact significance conclusion is arrived at, regardless of whether a particular audience agrees or disagrees with the conclusion.

Guidance can be drawn from the impact assessment literature and the argumentation literature to identify what constitutes comprehensive premises for impact significance determinations. The impact assessment literature suggests impact significance determinations are value based judgments about the degree of importance people place on changes brought

about by impacts (Lawrence, 2007a; Noble, 2010; Sadler, 1996; Sippe, 1999). Therefore, impact significance determinations can be considered to be value cases, as defined in the argumentation literature that I reviewed. The argumentation literature gives guidance on the types of premises that can support value based arguments. Thus, based on guidance from the impact assessment literature and guidance from the argumentation literature, it is recommended that the following premises are considered and presented in support of impact significance conclusions:

- fact based premises identifying the likelihood of an impact occurring;
- fact based premises describing predicted impact characteristics, such as impact magnitude, duration, frequency, and geographic extent;
- fact based premises describing the environmental (i.e., biophysical), social, economic, and regulatory context of impacts; and,
- value based premises for judgments made by various parties (e.g., technical experts and potentially affected people) on the importance or gravity impacts.

It is recommended that these premises be presented in a well-organized manner so that readers can easily decipher how conclusions and sub-conclusions are supported.

These categories of premises could drive the types of information that are collected during the stages of impact assessment leading up to final impact significance determinations and could be organized according to the categories of premises listed above. This would ensure that sufficient information is available during the significance analyses that are carried out at the culmination of impact assessments.

Recommendation 3: Develop and implement an improved method for impact significance determinations

It is recommended that the EAO's method for significance analysis be improved to address the findings of this study. To do this, it is recommended that a set of draft policies and procedures be developed, tested, and refined that:

- incorporate the two recommendations presented above;
- better explain how impact characteristics, impact context, and value judgments are considered and weighted in evaluating impact significance; and,
- explain why the method for evaluating impact significance is considered to be valid.

It is recommended that, during phases of testing and refinement, policies and procedures are shared with communities of practice, such as the International Association for Impact Assessment, to gather feedback and input from a range of impact assessment practitioners and experts.

Recommendation 4: Test draft arguments using a checklist

To further support the process of integrating the preceding recommendations into impact assessment practice, it is recommended that impact assessment practitioners engage with these recommendations by carrying out a quality assurance function for each other through a peer review process. This would allow impact assessment practitioners to engage with impact significance arguments as both authors (i.e., "arguers") and readers (i.e., "audiences" to arguments). To do this, it is recommended that authors' peers evaluate the extent to which draft impact significance cases are presented as clearly communicated and explicitly justified strong arguments. It is recommended that a checklist be developed to guide such an evaluation.

A peer review checklist could be used to guide authors' peers in evaluating the following aspects of arguments, using judgments that they believe would be characteristic of a technically informed, critical, and fair-minded reader:

- To what extent are all key terms adequately defined to alleviate potential vagueness and ambiguity?
- To what extent are the arguments well-organized, making conclusions and their premises readily apparent?
- To what extent are all conclusions and sub-conclusions (e.g., for impact significance factors) supported by explicit premises?
- To what extent are premises acceptable, as defined by Govier (2005)? For example, are premises believable, plausible, and free of errors in reasoning?
- To what extent are premises clearly relevant to ensuing conclusions, as defined by Govier (2005)? For example, to what extent is it apparent how conclusions on impact significance factors are relevant to, and therefore support, overall conclusions on impact significance?
- To what extent are premises collectively sufficient to justify ensuing conclusions, as defined by Govier (2005)? For example, to what extent are the types of fact and value premises presented that are identified above in Recommendation 2?

Peer review evaluations guided by a checklist developed from these questions would provide the EAO with a tool for evaluating impact significance arguments. The tool could be used to highlight any areas of a particular argument that could be strengthened to better justify impact significance conclusions.

Recommendation 5: Carry out further studies

Building on the findings of this study, several other types of studies could be carried out to further advance the practice of impact significance determinations, and impact assessment practice in general. Two ideas for potential studies are suggested here.

Argumentation and impact assessment

The tools of argumentation could be applied more broadly to carrying out and communicating impact assessments in general. Further studies could explore how the tools of argumentation could be used to isolate, better clarify, gather, and present the various types of data and rationale that are required to support various types of conclusions at distinct stages of the impact assessment process. Studies such as this could potentially serve to make the impact assessment process more focused, efficient, comprehensive, and robust.

Impact assessment and post-normal science, the psychology of decision making, and other fields concerned with how people establish and use values

Beyond argumentation, there are several other fields that explore how people establish personal and social values and integrate them, knowingly or otherwise, into arguments and decisions. Because impact assessment is an environmental management tool set within socio-economic decision making it is likely that these fields offer insights and guidance that could be used to further advance impact assessment practice. For example, the field of "post-normal science" directs attention and provides solutions for handling "uncertainty, value loading, and a plurality of legitimate perspectives" in decision making (Funtowicz & Ravetz, 2008, para.1), all of which are relevant to impact significance determinations and impact assessment in general.

Further studies could explore how the concepts and tools of various fields could be employed in impact significance determinations and in other aspects of the impact assessment process.

Concluding Statement

Evaluating the significance of impacts is recognized as one of the most critical activities of impact assessment (Duinker & Beanlands, 1983; Lawrence, 2007a; Noble, 2010; Rossouw, 2003; Sadler, 1996). It therefore plays an important part in contributing to impact assessment's role as an environmental management tool that can facilitate sustainable development. In impact assessment practice, impact significance determinations are a major meeting point of the three imperatives of sustainability: the environment, society, and the economy (Gibson, 2001). By presenting explicit and transparent arguments, these factors can be considered explicitly in the impact significance determinations carried out at the culmination of the impact assessment process. These determinations form a major part of decisions about whether projects are granted or refused permission to proceed and consequently whether the adverse and beneficial effects of major development projects will be allowed to occur.

The EAO supported this study out of an interest in advancing impact significance determination practice and impact assessment practice in general. The results of the study have identified opportunities for improvement and offered methods for moving forward. The results have also advanced impact assessment research by, at least partially, filling a gap in the research identified by Lawrence (2007b) with respect to how argument can be applied to impact significance determination practice.

By presenting thoroughly substantiated, and therefore transparent, impact significance cases using the tools of argumentation, it is possible to demonstrate how impact significance determinations achieve impact assessment's objective of facilitating sustainable development. In

addition to providing a well-established means of justifying conclusions, argumentation is a highly flexible framework for supporting conclusions that can systematically and consistently incorporate both fact based data and value-laden information about peoples' varying views of the gravity or acceptability of impacts (Lawrence, 2007b). Argument is also a familiar form of communication that is used in everyday conversation by the lay public and technical professionals alike. It is therefore an appropriate method to make impact significance cases readily understandable to a wide audience, thereby by contributing to the transparency of the impact assessment process.

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Appendix 1

Examples of argument analysis data from three impact significance cases.

significance case code	Significance analysis method described?	Rationale provided to justify method?	page range of effects assessment	random page number	Significance case (conclusion page number)
8	yes	no	xx	xx	xx
19	yes	no	xx	xx	xx
30	yes	no	xx	xx	xx

	To what extent are intended meanings of vague and/or ambiguous key terms for each factor subcase acceptably clarified? n/a = term not used in subcase no = no definition or other clarification provided insufficient = clarification provided but it is not sufficient to clarify the intended meaning yes = sufficiently clarified														
		general description of effect or impact			**magnitude**					**geographic extent**			**duration**		
significance case code	***significant***	***minimal***	***low***	***negligible***	***small***	***negligible***	***low***	***moderate***	***high***	***regional***	***local***	***project footprint***	***short term***	***medium term***	***long term***
8	no	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	yes	n/a	n/a
19	no	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
30	no	n/a	n/a	n/a	n/a	n/a	n/a	n/a	yes	n/a	n/a	n/a	n/a	n/a	n/a

	To what extent are intended meanings of potentially vague and/or ambiguous key terms clarified? n/a = term not used in subcase no = no definition or other clarification provided insufficient = clarification provided but it is not sufficient to clarify the intended meaning yes = sufficiently clarified								
	frequency			**reversibility**	**probability**			**context**	
significance case code	***infrequent***	***intermittent***	***sporadic***	***reversible***	***low***	***moderate***	***high***	***disturbed / undisturbed***	***developed / undeveloped***
8	n/a	no	n/a	no	n/a	n/a	n/a	n/a	n/a
19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
30	n/a	n/a	n/a	no	n/a	n/a	n/a	n/a	n/a

significance case code	To what extent are explicit and specific premises presented?							
	for significance conclusion? no = no specific and explicit premises presented yes = specific and explicit premises presented		for significance factor cases? no = no specific and explicit premises presented yes = specific and explicit premises presented a = acceptable r = relevant s = sufficient					
	grounds	warrant	magnitude	geographic extent	duration and frequency	reversibility	context	probability
8	yes	no	no	no	yes, a, r, s	no	no	no
19	yes	n/a	no case	no case	no case	no case	no case	no case
30	yes	no	no	no	yes, a, r, s	no	no	yes

significance case code	To what extent do premises support significance conclusion?						
			sufficient				
				impact context			
	acceptable	relevant	impact characteristics	environmental	economic	social	are value based premises for significance conclusion provided?
8	no	yes	sufficient	in a very limited way	not addressed	not addressed	not addressed
19	no case	no case	not addressed	not addressed	not addressed	not addressed	not addressed
30	no	yes	sufficient	in a very limited way	not addressed	not addressed	not addressed